

**SONY**

***SMO-F551 series***

***Magneto-Optical  
Disk Drive***

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**Version 1.1**

**SCSI Specifications**

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## REFERENCES

- SMO-F551 Technical Guide and Specifications
- Small Computer System Interface (SCSI-2), ANSI X3.131-1994
- ISO/IEC 15286-XXXX (WD) : Information Technology - 130 mm Optical Disk Cartridges - Capacity: 5,2 Gbyte per Cartridge - For Information Interchange
- ISO/IEC 14517-1997 : Information Technology - 130 mm Optical Disk Cartridges - Capacity: 2,6 Gbyte per Cartridge - For Information Interchange
- ISO/IEC 13549-1994 : Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 1,3 Gbyte per cartridge -
- ISO/IEC 10089-1991 : Information Technology -130 mm rewritable Optical Disk Cartridges for information Interchange
- ISO/IEC 11560-1992 : 130 mm Write Once Optical Disk Cartridges for Information Interchange - Capacity 650 Mega-bytes per Cartridge -

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# SECTION 1 INTRODUCTION

This document describes how the Sony SMO-F551 Magneto-Optical (MO) Disk Drive implements the SCSI specifications, defined by the American National Standard for Information Systems in the following documents:

- ANSI X3.131-1994 : Information Systems - Small Computer Systems Interface-2 (SCSI-2)
- ANSI X3T9.2-85-82 revision 4B : Common Command Set (CCS) of the Small Computer System Interface
- ANSI X3.131-1986 : Small Computer Systems Interface (SCSI)

For materials not described in this documents, refer to the following:

- SMO-F551 Technical Guide and Specifications
- ISO/IEC 15286-WD : **Information Technology - 130 mm Optical Disk Cartridges - Capacity 5,2 Gbyte per cartridge - For Information Interchange**
- ISO/IEC 14517-1997 : Information Technology - 130 mm Optical Disk Cartridges - Capacity 2,6 Gbyte per cartridge - For Information Interchange
- ISO/IEC 13549-1994 : Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 1,3 Gbyte per cartridge-
- ISO/IEC 10089-1991 Format A : 130 mm Rewritable Optical Disk Cartridges for Information Interchange
- ISO/IEC 11560-1992 : 130 mm Write Once Disk Cartridges for Information Interchange - Capacity 650Mega-bytes per Cartridge -

SECTION 2 describes all the SCSI specifications with the exception of the command descriptions of the drive. SECTION 3 describes the command specifications.

For 1.3 Gbytes and 650 Mbyte media, the drive can only READ the data and cannot write any data.

## SECTION 2 SCSI SPECIFICATION

This section gives brief descriptions on operations of the SCSI controller firmware.

### 2.1 PHASES

The drive supports all the phases specified in SCSI-2 standard (ANSI X3.131-1994). The following paragraphs describe each phase:

#### 2.1.1 ARBITRATION phase

When the drive tries to reconnect to an initiator for the purpose of continuing command operation, it waits for the BUS FREE phase to occur, and then enters the ARBITRATION phase.

#### 2.1.2 SELECTION phase

The drive detects if it is selected during this phase. The drive considers to be selected if the SEL and its SCSI ID bit are asserted and BSY and I/O are negated at least during the bus settle delay period. The drive examines the DATA BUS in order to recognize the initiator. And if it cannot detect the SCSI ID of the initiator, the drive does not respond to this selection.

#### 2.1.3 RESELECTION phase

When the drive tries to reconnect to an initiator for continuing the command operation, it reselects the initiator after winning the arbitration. If the initiator does not respond to RESELECTION within the Selection Time-Out Delay (250 ms), the drive releases the SCSI BUS. And after releasing the SCSI BUS for a short period of time (about 100  $\mu$ s), the drive retries RESELECTION after winning the arbitration. If the initiator cannot respond to the fifth retry of RESELECTION, the drive terminates the current I/O process. No pending data, status nor ending message will be sent for the operation.

#### 2.1.4 INFORMATION TRANSFER phase

When the information is transferred from an initiator to the drive, the drive performs a parity check if the SCSI Parity Checking function is enabled. When the information is transferred from the drive to an initiator, parity is always generated by the drive. Refer to the appropriate drive technical guide for detailed information about SCSI Parity Checking function.

### **2.1.5 DATA phase**

Data is transferred from the drive to the host during the DATA IN phase. On the other hand, data is transferred from the host to the drive during the DATA OUT phase.

If the parity error detection is enabled by the Functional Switch, the drive checks the parity during the DATA OUT phase. When a parity error is detected, the drive returns the CHECK CONDITION status to the initiator and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier to 0BH/47H/00H (ABORTED COMMAND/SCSI Parity Error).

When INITIATOR DETECTED ERROR message is sent from an initiator for the data transfer from the drive to the initiator, the drive returns CHECK CONDITION status and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 0BH/48H/00H (ABORTED COMMAND/Initiator Detected Error Message Received).

### **2.1.6 COMMAND phase**

COMMAND phase is a state that Command Descriptor Block (CDB) is sent from the initiator to the drive. CDB notifies the drive which operation is ordered by the initiator.

If the parity error detection is enabled, the drive checks the parity during the COMMAND phase. When a parity error is detected, the drive returns a CHECK CONDITION status and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier to 0BH/47H/00H (ABORTED COMMAND/SCSI Parity Error).

See SECTION 3 for detailed descriptions of the commands supported by the drive.

### **2.1.7 MESSAGE phase**

Message is sent from the drive to the host during the MESSAGE IN phase. On the other hand, message is sent from the host to the drive during the MESSAGE OUT phase.

If the parity error detection is enabled, the drive checks the parity during the MESSAGE OUT phase. When a parity error is detected, the drive retries the MESSAGE OUT phase according to the following sequence:

1. Continues the REQ/ACK handshakes until the initiator negates an ATN signal. (all message bytes are received).
2. Notifies the initiator to re-send all of the previous message byte(s) within the current phase while asserting REQ signals.

If the message is not received correctly, the drive terminates the present command with a CHECK CONDITION status and sets the Sense Key/Additional Sense Code/Additional Sense

## PHASES

Code Qualifier to 0BH/43H/00H (ABORT COMMAND /Message Error).

The drive supports following messages:

Code	Direction	Description
00H	IN	COMMAND COMPLETE
01H	IN/OUT	EXTENDED MESSAGE
02H	IN	SAVE DATA POINTER
03H	IN	RESTORE POINTERS
04H	IN	DISCONNECT
05H	OUT	INITIATOR DETECTED ERROR
06H	OUT	ABORT
07H	IN/OUT	MESSAGE REJECT
08H	OUT	NO OPERATION
09H	OUT	MESSAGE PARITY ERROR
0AH	IN	LINKED COMMAND COMPLETE
0BH	IN	LINKED COMMAND COMPLETE (WITH FLAG)
0CH	OUT	BUS DEVICE RESET
0DH	OUT	ABORT TAG
0EH	OUT	CLEAR QUEUE
20H	IN/OUT	SIMPLE QUEUE TAG
21H	OUT	HEAD OF QUEUE TAG
22H	OUT	ORDERED QUEUE TAG
80H-FFH	IN/OUT	IDENTIFY

(IN: drive to initiator OUT: Initiator to drive)

### COMMAND COMPLETE 00H

This message is sent from the drive to the initiator to indicate that a command has been executed and that a valid status has been sent to the initiator. After successfully sending this message, the drive goes to the BUS FREE phase by releasing BSY.

## EXTENDED MESSAGE 01H

This message is sent from either the initiator or the drive to indicate that the message is an EXTENDED MESSAGE. The drive only supports only the SYNCHRONOUS DATA TRANSFER REQUEST (SDTR) message.

An SDTR message exchange shall be initiated by a SCSI device whenever a previously-arranged data transfer agreement becomes invalid. The drive does not initiate the synchronous negotiation, but is capable to handle this message. The agreement becomes invalid after any condition which may leave the data transfer agreement in an intermediate status, such as:

- 1) after a hard reset condition performed by asserting RST signal ;
- 2) after a BUS DEVICE RESET message;
- 3) after a power cycle.

In addition, an initiator may initiate an SDTR message exchange whenever it is appropriate to negotiate a new data transfer agreement (either synchronous or asynchronous). The SDTR message exchange establishes a permissible transfer period and the REQ/ACK offset for all logical units and target routines on the two devices. This agreement only applies to DATA phases. The format of the SDTR message is as follows:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Extended Message (01H)
1								Extended Message length (03H)
2								SYNCHRONOUS DATA TRANSFER REQUEST code (01H)
3								Transfer Period Factor (m times 4 nanoseconds)
4								REQ/ACK Offset (x)

The transfer period is the minimum time allowed between leading edges of successive REQ pulses and ACK pulses.

The REQ/ACK offset is the maximum number of REQ pulses allowed to be outstanding before the leading edge of its corresponding ACK pulse is received at the target. This value is chosen to prevent the overflow conditions in the device's reception buffer and offset counter. A REQ/ACK offset value of zero indicates asynchronous mode.

The initiator sets its values according to the rules stated above to receive data successfully. If the drive can also receive data successfully with these values (or smaller transfer period or larger REQ/ACK offset or both), it returns the same values in its SDTR message. If it requires a longer transfer period, a smaller REQ/ACK offset, or both in order to receive data successfully, it alters SDTR message values as required. When transmitting data, each device shall respect

## PHASES

the limits set by the other's SDTR message, but it is permitted to transfer data with larger transfer periods, smaller REQ/ACK offsets, or both exceeding the specified limits of the other's SDTR message.

The implied synchronous agreement shall remain in effect until a BUS DEVICE RESET message is received; until a hard reset condition occurs; or until the initiator elects to modify the agreement. The default data transfer mode is asynchronous data transfer mode. The default data transfer mode is set at power on, after a BUS DEVICE RESET message, or after a hard reset condition.

### **Caution:**

The ANSI SCSI-2 standard recommends to set limits to the cable length and system configuration of the single end bus. And it is also suggested that the characteristic impedance of the cable should be within 90 to 132 \_.

### Synchronous negotiation started by the initiator

If the initiator recognizes that a negotiation is required, it asserts an ATN signal and sends an SDTR message to begin the negotiation process. After successfully completing the MESSAGE OUT phase, the drive will respond with the proper SDTR message. If an abnormal condition prevents the drive from returning an appropriate response, both devices shall turn into asynchronous mode for data transfer. The drive responds to each Initiator's Requested Transfer Period as shown in the following table:

Initiator's Requested Transfer Period Factor	Response	<u>SMO-F551</u>
Transfer Period		
(Fast SCSI Enabled)		
0 ≤ mi ≤ 25	mt = 25	100 nsec
26 ≤ mi ≤ 31	mt = mi	125 nsec
32 ≤ mi ≤ 37	mt = mi	150 nsec
38 ≤ mi ≤ 43	mt = mi	175 nsec
44 ≤ mi ≤ 50	mt = mi	200 nsec
(Fast SCSI Disabled)		
0 ≤ mi ≤ 50	mt = 50	200 nsec
51 ≤ mi ≤ 56	mt = mi	225 nsec
57 ≤ mi ≤ 62	mt = mi	250 nsec
63 ≤ mi ≤ 68	mt = mi	275 nsec
69 ≤ mi ≤ 75	mt = mi	300 nsec
76 ≤ mi ≤ 225	mt = mi	Asynchronous (REQ/ACK offset 0 )

The drive responds to each initiator's requested REQ/ACK offset as follows:

Initiator's Requested REQ/ACK Offset	Response	<u>SMO-F551</u>
REQ/ACK Offset		
0 ≤ xi ≤ 15	xt = xi	xt
15 < xj ≤ 255	xt = 15	15

### **SAVE DATA POINTER 02H**

This message is sent from the drive to direct the initiator to save the address of the present active data pointer for currently attached logical unit. The drive issues this message when it disconnects the SCSI BUS during the data transfer or when a block of data is transferred.

### **RESTORE POINTERS 03H**

This message is sent from the drive to direct the initiator to restore the most recently saved pointers to an active state. The drive may send this message when INITIATOR DETECTED ERROR message is sent from the initiator during STATUS phase.

### **DISCONNECT 04H**

This message is sent from the drive to inform the initiator that the present physical path is going to be disconnected, but a later reconnection will be required in order to complete the current operation.

### **INITIATOR DETECTED ERROR 05H**

When the drive receives this message during STATUS phase, it may retry the transfer after sending RESTORE POINTERS message.

### **ABORT 06H**

This message is sent from the initiator to the drive to clear the present operation and all the pending command to the drive. All the pending data and status made by the current command is cleared, too, and the drive turns into BUS FREE phase. Pending data and status for other initiators are not cleared. No status or ending message is sent for this operation.

## MESSAGE REJECT 07H

This message is sent from either the initiator or the drive to indicate that the last message was inappropriate or has not been implemented.

When the drive receives a MESSAGE REJECT message from the initiator, it takes the following action based on which message is rejected.

**COMMAND COMPLETE:** The drive turns into BUS FREE phase and does not consider this as an error.

**DISCONNECT:** The drive does not disconnect and continues the current command.

**IDENTIFY:** The drive turns into the BUS FREE phase and aborts the command. Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 0BH/43H/00H (ABORTED COMMAND/Message Error).

**LINKED COMMAND COMPLETE or LINKED COMMAND COMPLETE (WITH FLAG):** The drive turns into BUS FREE phase and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 0BH/43H/00H (ABORTED COMMAND/Message Error).

**MESSAGE REJECT:** The drive terminates the command with CHECK CONDITION status and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 0BH/43H/00H (ABORTED COMMAND/Message Error).

**RESTORE POINTERS:** The drive turns into the BUS FREE phase and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier according to the error condition.

**SAVE DATA POINTER:** The drive does not disconnect and continues the current command.

### **NO OPERATION 08H**

This message is ignored by the drive.

### **MESSAGE PARITY ERROR 09H**

When the drive receives this message, it retries the operation by resending the original message once. If the message cannot be sent successfully, the drive immediately turns into the BUS FREE phase and aborts the current SCSI command. No further reconnection is attempted and no status or COMMAND COMPLETE message is returned.

### **LINKED COMMAND COMPLETE 0AH**

This message is sent from the drive to an initiator to indicate that the execution of LINKED COMMAND has been completed and the status has been sent.

### **LINKED COMMAND COMPLETE (WITH FLAG) 0BH**

This message is sent from the drive to an initiator to indicate that the execution of LINKED COMMAND (with the flag bit set to 1) has been completed and the status has been sent.

### **BUS DEVICE RESET 0CH**

This message is sent from an initiator to reset the drive.

### **ABORT TAG 0DH**

The drive turns into the BUS FREE phase following a successful receipt of the ABORT TAG message and clears the current I/O process. If the drive has already started the execution of I/O process, the execution will be halted. The medium contents may be modified before the execution is halted.

### **CLEAR QUEUE 0EH**

The drive turns into the BUS FREE phase following a successful receipt of the CLEAR QUEUE message. The drive clears all I/O process from all the initiators in the queue for the specified logical unit from the queue. All the active I/O process are terminated. The medium may have been altered by partially executed commands. All the pending status and data for the specified logical unit are cleared. UNIT ATTENTION condition is generated for all the other initiators with I/O process that either were active or were queued for the logical unit. Additional Sense Code/Additional Sense Code Qualifier is set to 2FH/00H (Command Cleared by Another Initiator).

## QUEUE TAG MESSAGES (20H, 21H, 22H)

The drive supports SIMPLE QUEUE TAG, HEAD OF QUEUE TAG and ORDERED QUEUE TAG. The Queue Tag Message consist of two consecutive bytes, Message Code (20H, 21H or 22H) and Queue Tag (00H-FFH) to distinguish each I/O process. The Queue Tag must be unique for each I/O process, but the numeric values of queue tags have no effect on the order of execution.

### SIMPLE QUEUE TAG 20H

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Message Code (20H)
1								Queue Tag (00H - FFH)

The SIMPLE QUEUE TAG message specifies that the I/O process will be placed in the logical unit's command queue. Order of the execution may be altered.

### HEAD OF QUEUE TAG 21H

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Message Code (21H)
1								Queue Tag (00H - FFH)

The HEAD OF QUEUE TAG message specifies that the I/O process will be placed at first in the logical unit's command queue. When the drive receives a subsequent I/O process received with a HEAD OF QUEUE TAG message, the I/O process which has been already requested is not interrupted.

### ORDERED QUEUE TAG 22H

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Message Code (22H)
1								Queue Tag (00H - FFH)

The ORDERED QUEUE TAG message specifies that the I/O process will be placed in the logical unit's command queue for execution in the received order. All the queued I/O processes for the logical unit received prior to this I/O process are executed before this I/O process is executed. All the queued I/O processes received after the I/O process are executed after this I/O process, except for I/O process received with a HEAD OF QUEUE TAG message.

## **IDENTIFY 80H-FFH**

These messages are sent by either the initiator or the drive to establish a physical path connection between the initiator and the drive.

**Bit 7** This bit is always set to 1.

**Bit 6** This bit is set to 1 by the initiator to indicate that the initiator has been granted an ability to accommodate the disconnection and reconnection.

**Bit 5-3** This bit is reserved.

**Bit 2-0** These bits specify a logical unit number.

### **2.1.8 STATUS phase**

A status byte is sent from the drive to the initiator during the STATUS phase at the termination of each command unless the command is cleared by an ABORT, BUS DEVICE RESET, ABORT TAG, CLEAR QUEUE message, or RESET condition. The drive supports the following status codes:

<b>Code</b>	<b>Status</b>
00H	GOOD
02H	CHECK CONDITION
04H	CONDITION MET
08H	BUSY
10H	INTERMEDIATE/GOOD
14H	INTERMEDIATE-CONDITION MET
18H	RESERVATION CONFLICT
28H	QUEUE FULL

#### **GOOD 00H**

This status indicates that the target has successfully completed the command.

#### **CHECK CONDITION 02H**

Any error, exception, or abnormal condition that causes sense data to be set, causes a CHECK CONDITION status. The REQUEST SENSE command should be issued following a CHECK CONDITION status, to determine the nature of the condition.

**CONDITION MET 04H**

This status or INTERMEDIATE-CONDITION MET is returned when the PRE-FETCH operation is satisfied. (See the PRE-FETCH command).

**BUSY 08H**

This status is returned by the drive during the power-up until all the diagnostics have been completed.

**INTERMEDIATE/GOOD 10H**

Unless an error, exception, or abnormal condition causes a CHECK CONDITION status or a RESERVATION CONFLICT status, the INTERMEDIATE/GOOD status is returned for every command in series of linked commands, excluding the last command. If this status is not returned, the chain of linked commands is broken; no further commands in the series are executed.

**INTERMEDIATE-CONDITION MET 14H**

This status is the combination of the CONDITION MET and INTERMEDIATE status.

**RESERVATION CONFLICT 18H**

This status is returned when a SCSI device attempts to access a logical unit which is reserved for another initiator.

**QUEUE FULL 28H**

This status is returned when any of the SIMPLE QUEUE TAG, ORDERED QUEUE TAG, or HEAD OF QUEUE TAG message is received and the command queue of the drive is full. The I/O process is not placed in the command queue. The drive can handle thirty two I/O process at a time.

## 2.2 SCSI BUS CONDITIONS

### 2.2.1 ATTENTION condition

The ATTENTION condition allows an initiator to inform the drive that the initiator has a message ready. The drive gets this message by performing a MESSAGE OUT phase as follows.

- a) If the ATN signal becomes true during a COMMAND phase, the drive enters MESSAGE OUT phase after transferring part or all of the command descriptor block bytes.
- b) If the ATN signal becomes true during a DATA phase, the drive enters MESSAGE OUT phase at the drive's earliest convenience. The initiator shall continue REQ/ACK handshakes until it detects the phase change.
- c) If the ATN signal becomes true during a STATUS phase, the drive enters MESSAGE OUT phase after the status byte has been acknowledged by the initiator.
- d) If the ATN signal becomes true during a MESSAGE IN phase, the drive enters MESSAGE OUT phase before it sends another message.
- e) If the ATN signal becomes true before the initiator releases the BSY signal during a SELECTION phase, the drive enters MESSAGE OUT phase immediately after that SELECTION phase.
- f) If the ATN signal becomes true during a RESELECTION phase, the drive enters MESSAGE OUT phase after the drive has sent its IDENTIFY message for that RESELECTION phase.

### **2.2.2 RESET condition**

The drive implements the hard reset alternative upon detection of the RESET condition. When the drive sets a reset condition, it clears all I/O processes including queued I/O processes and releases all the reservations. It also resets all the SCSI device's operating modes (MODE SELECT, PREVENT/ALLOW MEDIUM REMOVAL commands, etc.) to their initial conditions and generates UNIT ATTENTION condition.

### **2.2.3 UNIT ATTENTION condition**

A UNIT ATTENTION condition for a logical unit begins for each initiator when the medium is loaded (inserted into the drive unit), the drive is reset, or MODE SELECT parameters are changed. The UNIT ATTENTION condition persists for each initiator until that initiator issues a command to the logical unit other than the REQUEST SENSE or INQUIRY for which the drive returns the CHECK CONDITION status. If the next command from that initiator to the logical unit (following the CHECK CONDITION status) is REQUEST SENSE, UNIT ATTENTION Sense Key is returned. (If any command other than REQUEST SENSE is received, the UNIT ATTENTION condition is lost.)

If an INQUIRY command is received from an initiator with a pending UNIT ATTENTION condition (before the drive reports CHECK CONDITION status), the drive performs the INQUIRY command and does not clear the UNIT ATTENTION.

If a REQUEST SENSE command is received from an initiator with a pending UNIT ATTENTION condition (before the drive reports CHECK CONDITION status), the drive reports UNIT ATTENTION Sense Key and clears the UNIT ATTENTION condition for that initiator.

### 2.3 DISK FORMAT

The drive will manage a 130 mm Magneto-Optical Drive and disk as an optical memory device under the SCSI-2 operating definition. It supports the ISO/IEC standard for 130 mm Optical Disk and the defect management scheme described by the standard.

The drive supports two disk-management mode, Format Mode 3 and Format Mode 4. The Format Mode 3 is for the 650 Mbyte/cartridge medium and the Format Mode 4 corresponds to the 1.3 Gbyte/cartridge, 2.6 Gbyte/cartridge and 5.2 Gbytes/cartridge medium.

#### Format Mode 3

The Format Mode 3 is for 650 Mbyte/cartridge medium. In Format Mode 3, tracks from 0 to 2 and from 18748 to 18750 are used for DDS, PDL and SDL. And tracks from 3 to 18747 is used for user area (data blocks + spare blocks)

#### Format Mode 4

Format Mode 4 is for 1.3 Gbyte/cartridge, 2.6 Gbyte/cartridge and 5.2 Gbyte/cartridge medium.

For 1.3 Gbyte/cartridge media, tracks from 0 to 2 and from 37597 to 37599 are used for DDS, PDL and SDL. And tracks from 3 to 37596 is used for user area (data blocks + spare blocks).

For 2.6 Gbytes/cartridge media (1024 byte/sector), tracks from 0 to 4 and from 75722 to 75726 are used for DDS, PDL and SDL. And tracks from 5 to 75721 is used for user area (data blocks + spare blocks).

For 2.3 Gbyte/cartridge media (512 byte/sector), tracks from 0 to 4 and from 73067 to 73071 are used for DDS, PDL and SDL. And tracks from 5 to 73066 is used for user area (data blocks + spare blocks).

For 5.2 Gbyte/cartridge media (2048 byte/sector), tracks from 0 to 5 and from 182482 to 182487 are used for DDS, PDL and SDL. And tracks from 6 to 182481 is used for user area (data blocks + spare blocks).

For 4.8 Gbyte/cartridge media (1024 byte/sector), tracks from 0 to 5 and from 138894 to 138899 are used for DDS, PDL and SDL. And tracks from 6 to 138893 is used for user area (data blocks + spare blocks).

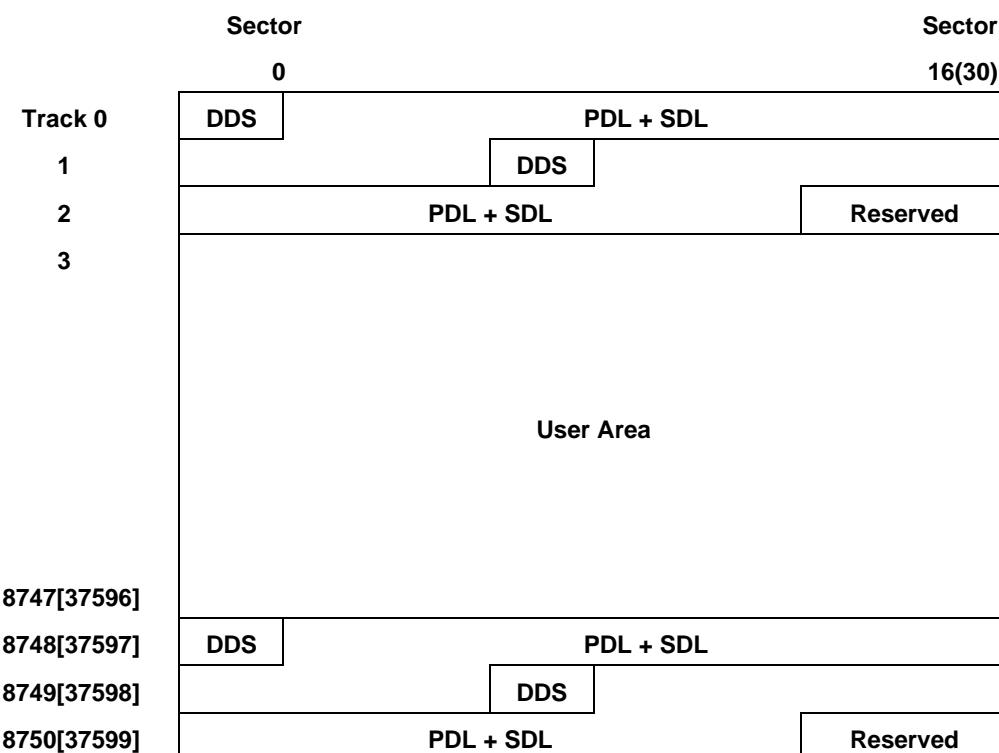
For 4.1 Gbyte/cartridge media (512 byte/sector), tracks from 0 to 5 and from 130091 to 130096 are used for DDS, PDL and SDL. And tracks from 6 to 130090 is used for user area (data blocks + spare blocks).

**ISO/IEC standard defect management scheme**

The disk is divided into several areas and is managed by the SMO-F551.

The following figure shows how 650 Mbyte and 1.3 Gbyte media is managed:

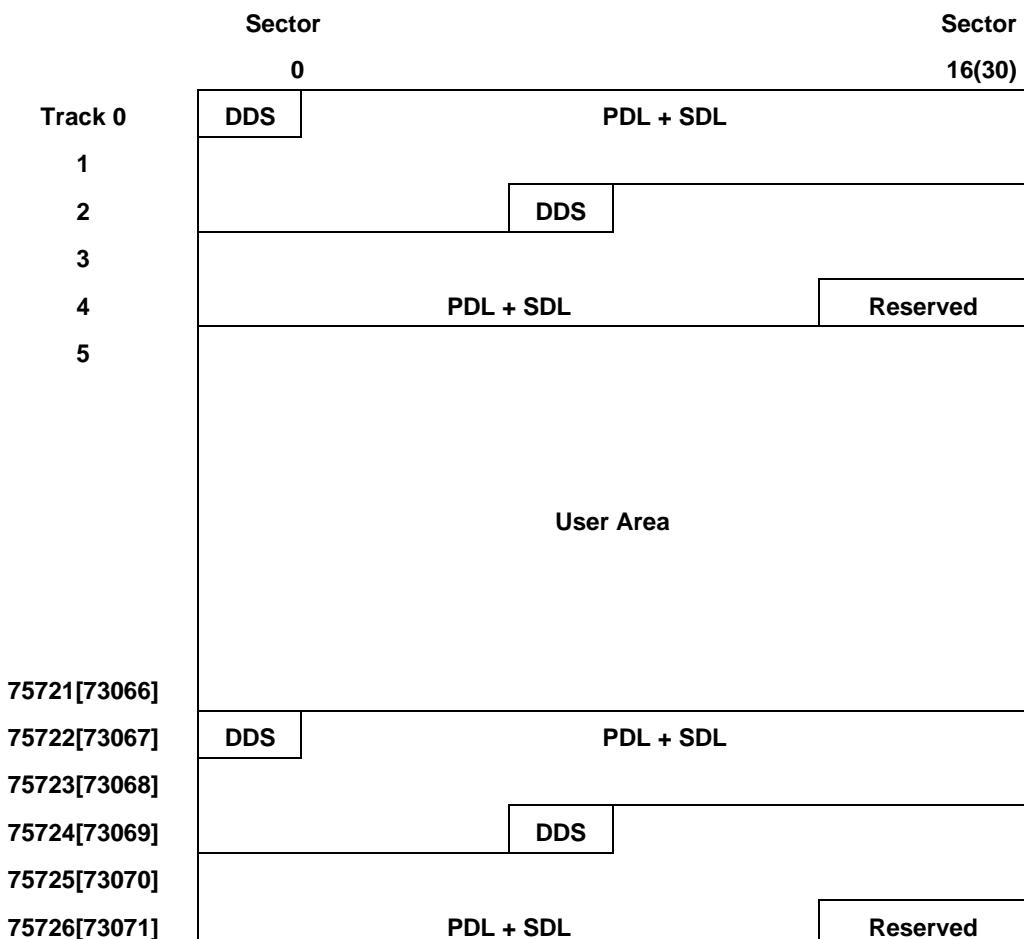
([   ] 1.3Gbyte/cartridge medium, (   ) 512byte medium)



## DISK FORMAT

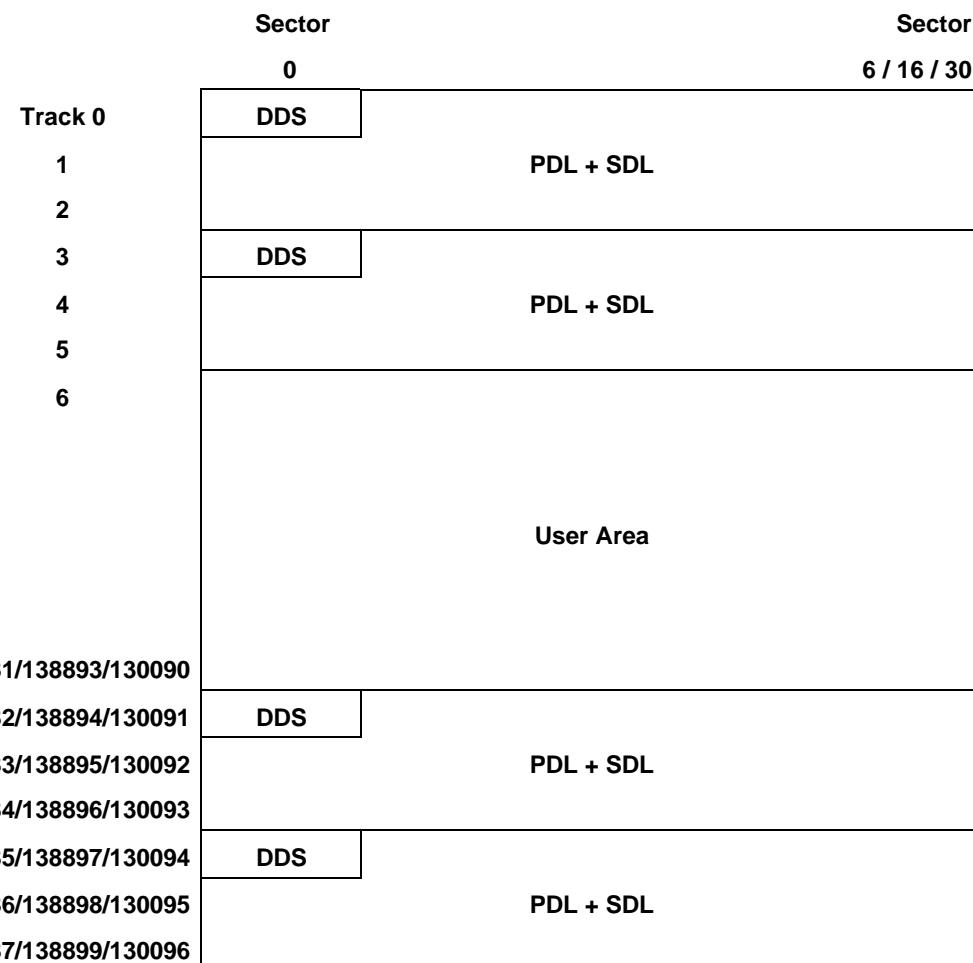
The following figure shows how 2.6 Gbyte media is managed:

([ ]) 2.3Gbyte/cartridge medium, , ( ) 512byte medium)



The following figure shows how 5.2 Gbyte is managed:

- 5.2 Gbyte media : 2048 byte / sector
- 4.8 Gbyte media : 1024 byte / sector
- 4.1 Gbyte media : 512 byte / sector
- (2048 byte / 1024 byte / 512 byte medium)



DDS (Disk Definition Structure) defines the defect allocation algorithm and the way the user and spare area is divided into data blocks and spare blocks. PDL (Primary Defect List) is established upon the certification of the medium. SDL (Secondary Defect List) is used to record defective sectors after the certification of the medium.

## SECTION 3 COMMANDS

### 3.1 INTRODUCTION

This section describes detailed functions of each command supported by the drive. Commands under the SCSI-2 operating definition are described in this manual. Entries are arranged in order of the operation code.

Each entry includes:

- Command name
- Operation code
- Brief description of the command (FUNCTION)
- Command Descriptor Block (CDB)
- Detailed descriptions on each parameter

The following are explanations of each component:

#### **Command name and operation code**

Command name and operation code are printed at the first line of each entry in large fonts. The operation code is expressed in hexadecimal notation.

#### **FUNCTION**

Brief description on the command is described here.

#### **CDB**

This part describes the format of the command supported by the drive. The logical unit number field specifies the logical unit while the IDENTIFY message is not sent to the drive. If the logical unit is specified by the IDENTIFY message, content of this field is ignored by the drive. The link bit of 1 indicates that the drive links to the following command upon successful completion of the current command. When the command is terminated successfully, the drive returns an INTERMEDIATE/GOOD status and a LINKED COMMAND COMPLETE or a LINKED COMMAND COMPLETE (WITH FLAG) message depending on the state of the flag bit. The flag bit may be set to 1 only when the link bit is 1. If this bit and link bit are set to 1, the drive returns a LINKED COMMAND COMPLETE (WITH FLAG) message upon successful completion of the command. If this bit is set to 0, it returns the LINKED COMMAND COMPLETE message. During the linked commands, the logical unit number field value has to remain the same unless the logical unit number is specified by the IDENTIFY message. If the logical unit number field

is different from the value of the previous CDB, the command returns a CHECK CONDITION status and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier to 05H/25H/00H (ILLEGAL REQUEST/Logical Unit Not Supported).

Some group 1 or group 5 commands have a Relative Address (RelAdr) bit. The RelAdr bit is set to 1 to indicate that the Logical Block Address of the Command Descriptor Block is a displacement expressed with two's complement. This negative or positive displacement is added to the Logical Block Address accessed last.

The Reserved (or Rsvrd) field indicates that the field is reserved and has to be set to 0 by the initiator.

#### **Detailed descriptions on each parameter**

Detailed descriptions on the parameters under the SCSI-2 operating definition are explained.

### 3.2 COMMANDS under SCSI-2 Operating Definition

The drive supports the following group 0, group 1, group 2, group 5 and group 6 commands under SCSI-2 operating definition (upper 3 bits of the operation code is called group code).

#### Group 0 (6-byte command)

Code	Description
00H	TEST UNIT READY
01H	REZERO UNIT
03H	REQUEST SENSE
04H	FORMAT UNIT
07H	REASSIGN BLOCKS
08H	READ(6)
0AH	WRITE(6)
0BH	SEEK(6)
12H	INQUIRY
15H	MODE SELECT(6)
16H	RESERVE
17H	RELEASE
1AH	MODE SENSE(6)
1BH	START/STOP UNIT
1CH	RECEIVE DIAGNOSTIC RESULTS
1DH	SEND DIAGNOSTIC
1EH	PREVENT/ALLOW MEDIUM REMOVAL

**Group 1 (10-byte command)**

<b>Code</b>	<b>Description</b>
25H	<b>READ CAPACITY</b>
28H	<b>READ(10)</b>
2AH	<b>WRITE(10)</b>
2BH	<b>SEEK(10)</b>
2CH	<b>ERASE(10)</b>
2EH	<b>WRITE AND VERIFY(10)</b>
2FH	<b>VERIFY(10)</b>
34H	<b>PRE-FETCH</b>
35H	<b>SYNCHRONIZE CACHE</b>
37H	<b>READ DEFECT DATA(10)</b>
38H	<b>MEDIUM SCAN</b>
3BH	<b>WRITE BUFFER</b>
3CH	<b>READ BUFFER</b>
3EH	<b>READ LONG</b>
3FH	<b>WRITE LONG</b>

**Group 2 (10-byte command)**

<b>Code</b>	<b>Description</b>
40H	<b>CHANGE DEFINITION</b>
4CH	<b>LOG SELECT</b>
4DH	<b>LOG SENSE</b>
55H	<b>MODE SELECT(10)</b>
5AH	<b>MODE SENSE(10)</b>

**Group 5 (12-byte command)**

<b>Code</b>	<b>Description</b>
A8H	<b>READ(12)</b>
AAH	<b>WRITE(12)</b>
ACH	<b>ERASE(12)</b>
AEH	<b>WRITE AND VERIFY(12)</b>
AFH	<b>VERIFY(12)</b>
B7H	<b>READ DEFECT DATA(12)</b>

**Group 6 (10-byte command)**

<b>Code</b>	<b>Description</b>
DEH	<b>READ LONG</b>
DFH	<b>WRITE LONG</b>

**TEST UNIT READY****00H****FUNCTION**

Determines the READY state of the drive. If the drive is in a READY state when it receives this command, it returns a GOOD status. The drive is in a READY state when the optical disk is loaded and spun up, and medium-access command can be successfully completed. If the drive is not READY when it receives this command, it returns a CHECK COMMAND CONDITION status with Sense Key of NOT READY.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
0	Operation Code (00H)												
1	Logical Unit Number			Reserved									
2	Reserved												
3	Reserved												
4	Reserved												
5	Reserved					Flag	Link						

**REZERO UNIT****01H****FUNCTION**

Function of this command is exactly the same with the function of TEST UNIT READY command.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0						
0	Operation Code (01H)													
1	Logical Unit Number		Reserved											
2	Reserved													
3	Reserved													
4	Reserved													
5	Reserved				Flag		Link							

**REQUEST SENSE****03H****FUNCTION**

REQUEST SENSE command is used to identify the error condition when the drive fails to complete a command and returns a CHECK CONDITION status. Sense Data is preserved for the initiator until it is retrieved by a REQUEST SENSE command or until the drive receives another command.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
<b>0</b>	Operation Code (03H)												
<b>1</b>	Logical Unit Number			Reserved									
<b>2</b>	Reserved												
<b>3</b>	Reserved												
<b>4</b>	Allocation Length												
<b>5</b>	Reserved					Flag	Link						

**Allocation Length**

This field indicates the number of sense data bytes that the drive will transfer to the initiator. This drive has 22 bytes of sense data. If an allocation length specified is less than 22, then the allocated amount is transferred while the remaining sense data is lost, and no error will be reported. If the specified allocation length is greater than 22, then only 22 bytes of sense data are transferred and no error will be reported.

## Sense Data Format

The table below shows the format of the Sense Data which consists of twenty two bytes:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Valid							Error Code (70H or 71H)
1								Reserved
2	Reserved		ILI	Reserve				Sense Key
3								Information Byte (MSByte)
4								Information Byte
5								Information Byte
6								Information Byte (LSByte)
7								Additional Sense Length (0EH)
8								Reserved
9								Reserved
10								Reserved
11								Reserved
12								Additional Sense Code
13								Additional Sense Code Qualifier
14								Reserved
15	SKSV							Sense Key Specific Information
16								Sense Key Specific Information
17								Sense Key Specific Information
18								Internal Error Code (MSByte)
19								Internal Error Code
20								Internal Error Code
21								Internal Error Code (LSByte)

### Valid

Valid bit of 1 indicates that Information Byte field contains valid information related to Additional Sense Code and Additional Sense Code Qualifier.

### ILI

An incorrect length indicator(ILI) bit of 1 indicates that the requested logical block length did not match the logical block length of the data on the medium.

### Error Code

Error code 70H indicates that returned CHECK CONDITION status is the result of an error condition of the I/O process. Error Code 71H (deferred error) indicates that the returned

CHECK CONDITION status is the result of an error or exceptional condition that occurred during the execution of a previous command for which GOOD status has already been returned. Such commands are associated with the use of immediate bit or some forms of caching.

### Sense Key

Sense Key provides generic categories in which errors or exceptional conditions can be reported. The following Sense Keys are implemented in the drive:

Sense Key	Description
0H	<b>NO SENSE</b> Indicates that there is no specific Sense Key information to be reported for the designated logical unit. This Sense Key is returned when the command is successfully completed.
1H	<b>RECOVERED ERROR</b> Indicates that the last command is successfully completed with some recovery action performed by the drive.
2H	<b>NOT READY</b> Indicates that the logical unit cannot be accessed.
3H	<b>MEDIUM ERROR</b> Indicates that the command is terminated with an unrecovered error condition caused by a medium defect.
4H	<b>HARDWARE ERROR</b> Indicates that the drive has detected a hardware error.
5H	<b>ILLEGAL REQUEST</b> Indicates that there is an illegal parameter in the Command Descriptor Block or in the additional parameters supplied as data for some commands.
6H	<b>UNIT ATTENTION</b> Indicates that the medium has been loaded and the unit has been reset or the Mode Select parameters have been changed.
7H	<b>DATA PROTECT</b> Indicates that a write command is attempted but cannot be performed due to the Write Protect setting of the medium cartridge switch.
8H	<b>BLANK CHECK</b> A blank sector was detected during READ or VERIFY command, or a written sector was detected during WRITE, VERIFY or WRITE AND VERIFY command.
BH	<b>ABORTED COMMAND</b> Indicates that the drive has aborted the last command. The initiator may be able to recover by trying the command again.

### Information Byte

If Valid bit is set to 1, Information Byte contains valid information related to Additional Sense Code and Additional Sense Code Qualifier.

### Additional Sense Length

Additional Sense Length indicates the length of data which follows this field. When the allocation length of the Command Descriptor Block is too small to transfer all the additional sense bytes, Additional Sense Length is not adjusted to reflect the truncation.

### Additional Sense Code and Additional Sense Code Qualifier

Additional Sense Code and Additional Sense Code Qualifier further defines the Sense Key.

### SKSV

Sense Key Specific Valid bit being 1 indicates that Sense Key Specific Information is valid. This bit is set to 1 only when the Sense Key is set to ILLEGAL REQUEST. Sense Key Specific Valid bit of 0 indicates that there is no Sense Key Specific Information.

### C

The drive sets the SKSV bit to 1 only if the Sense Key is set to ILLEGAL REQUEST and the Sense Key Specific Information is defined as the following table. This information indicates which parameters in Command Descriptor Blocks or data parameters has an error.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
15	SKSV	C/D	Reserved	BPV	Bit Pointer							
16	Field Pointer (MSByte)											
17	Field Pointer (LSByte)											

### C/D

Command Data bit of 1 indicates that illegal parameter exist in the Command Descriptor Block. This bit of 0 indicates that illegal parameters are in the data parameters sent by the initiator during the DATA OUT phase.

### BPV

Bit Pointer Valid bit of 0 indicates that value in the Bit Pointer field is not valid. Bit Pointer Valid bit of 1 indicates that Bit Pointer field specifies a valid information.

### **Bit Pointer**

When the Bit Pointer Valid bit is 1, Bit Pointer field specifies which bit of byte designated by the Field Pointer field has an error. When multiple-bit field is in error, the Bit Pointer field points to the most significant bit of the field.

### **Field Pointer**

Field Pointer field indicates which byte of the Command Descriptor Block or the parameter data has an error. Bytes are numbered starting from 0, as shown in the tables describing the commands and parameters. When a multiple-byte field is in error, the bit pointer field points to the most-significant byte of the field.

### **Sense Key Specific Information**

The drive sets the SKSV bit to 1 if the sense key is NOT READY, and the Sense Key Specific Information is defined as the following table. These fields only apply to the FORMAT UNIT command with the Immed bit set to 1.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
15	SKSV							Reserved
16								Progress Indication (MSByte)
17								Progress Indication (LSByte)

### **Internal Error Code**

Please refer to Appendix A: Internal Error Code for information on failures.

**Additional Sense Code and Additional Sense Code Qualifier**

Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) provide either detailed error information or the drive condition. The following lists show the ASC's and ASCQ's implemented by the drive and the related Sense Keys.

<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
00H	00H	<b>No Additional Sense Information (NO SENSE)</b> No Additional Sense Information to be reported.
03H	00H	<b>Write Fault (HARDWARE ERROR)</b> Error in write operation .
04H	00H	<b>Drive Not Ready (NOT READY)</b> READY signal from the drive block was negated.
04H	01H	<b>Logical Unit is in Process of Becoming Ready (NOT READY)</b> The drive is in process of becoming READY while loading or spinning up.
04H	04H	<b>Logical Unit Not Ready, Format in Progress (NOT READY)</b> The drive is in process of formatting by FORMAT UNIT command.
09H	01H	<b>Tracking Servo Failure (HARDWARE ERROR)</b> Tracking servo failed.
09H	02H	<b>Focus Servo Failure (HARDWARE ERROR)</b> Focus servo failed.
09H	03H	<b>Spindle Servo Failure (HARDWARE ERROR)</b> Spindle motor is not at the specified speed.
0CH	01H	<b>Write Error Recovered with Auto Reallocation (RECOVERED ERROR)</b> Automatic write reallocation was executed successfully.
0CH	02H	<b>Write Error Auto Reallocation Failed (MEDIUM ERROR)</b> Automatic write reallocation failed to recover write error.
10H	00H	<b>ID CRC Error (HARDWARE ERROR)</b> The ID field cannot be read.

<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
11H	00H	<b>Unrecovered Read Error of Data Block (MEDIUM ERROR)</b> Data error could not be corrected by the Error Correction Code. The Logical Block Address where the error was detected may be returned in the Logical Block Address field or the Information Byte field of the sense data.
15H	00H	<b>Random Positioning Error (HARDWARE ERROR)</b> Seek failure or not on correct track.
16H	00H	<b>Data Synchronization Mark Error (MEDIUM ERROR)</b> Data synchronization cannot be found.
18H	00H	<b>Recovered Read Data with ECC Procedure (RECOVERED ERROR)</b> Interleave containing 7 or 8 error bytes was located. Error correction was successful.
18H	01H	<b>Recovered Data with retries (RECOVERED ERROR)</b> Recovered by retry.
19H	01H	<b>Defect List Not Available (MEDIUM ERROR or RECOVERED ERROR)</b> Specified defect list is not available.
1AH	00H	<b>Parameter List Length Error (ILLEGAL REQUEST)</b> There is an error in the received Parameter List Length field.
1BH	00H	<b>Synchronous Data Transfer Error (HARDWARE ERROR)</b> Synchronous data transfer was missed.
1CH	00H	<b>Defect List Not Found (MEDIUM ERROR)</b> Defect list cannot be found.
1CH	01H	<b>Primary Defect List Not Found (MEDIUM ERROR)</b> Cannot read PDL.
1CH	02H	<b>Grown Defect List Not Found (MEDIUM ERROR)</b> Cannot read SDL.
20H	00H	<b>Invalid Command Operation Code (ILLEGAL REQUEST)</b> The specified command operation code is not implemented or an invalid commands is requested.
21H	00H	<b>Logical Block Address Out of Range (ILLEGAL REQUEST)</b> The specified Logical Block Address was outside of the valid area.

<b>ASC</b>	<b>ASCC</b>	<b>Description</b>
24H	00H	<b>Illegal Field in CDB (ILLEGAL REQUEST)</b> There is an error in the received Command Descriptor Block (CDB). This Additional Sense Code is returned under the following situations. -- A reserved field in CDB is not 0. -- Invalid combination of parameters – Illegal parameter at that state (e.g. A command using the relative address (RelAdr) bit set to 1 was issued after a command who's link bit was not 1).
25H	00H	<b>Logical Unit Not Supported (ILLEGAL REQUEST)</b> LUN 1 through 7 was specified or the specified LUN (0 ) did not respond to the selection from the SCSI controller block.
26H	00H	<b>Invalid Parameter List (ILLEGAL REQUEST)</b> The received parameter list contains invalid information.
26H	01H	<b>Parameter Not Supported (ILLEGAL REQUEST)</b> The received parameter(s) is/are not supported.
26H	02H	<b>Parameter Value Invalid (ILLEGAL REQUEST)</b> The received parameter(s) is/are invalid.
27H	00H	<b>Write Protected (DATA PROTECT)</b> Erasing or writing is aborted because the write protect switch of the cartridge is on.
28H	00H	<b>Medium Changed (UNIT ATTENTION)</b> Medium was loaded. This Additional Sense Code was used to notify the initiator that the medium had been changed since the execution of the last command. This code implies that the Mode Select Parameters might have been changed (2AH ; 00H).
29H	00H	<b>Power On or Reset or Bus Device Reset Occurred (UNIT ATTENTION)</b> This is used to notify the initiator that a RESET condition has taken place since the last execution of the command. This code implies that the Mode Select Parameters may be changed.
2AH	00H	<b>Mode Select Parameters Changed (UNIT ATTENTION)</b> This is used to notify the initiator that the mode select parameters have been changed since the execution of the last command.
2FH	00H	<b>Command Cleared by Another Initiator (UNIT ATTENTION)</b> The drive received the CLEAR QUEUE message.

<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
30H	00H	<b>Incompatible Cartridge</b> (MEDIUM ERROR) The ID hole(s) location of the cartridge is/are invalid.
30H	02H	<b>PEP Invalid</b> (MEDIUM ERROR) PEP data is invalid.
31H	00H	<b>Medium Format Corrupted</b> (MEDIUM ERROR) PEP, SFP or/and DDS is/are invalid.
32H	00H	<b>No Defect Spare Location Available</b> (MEDIUM ERROR) The number of defect sectors listed on the PDL and SDL exceeded the limit.
32H	01H	<b>Defect List Update Failure</b> (MEDIUM ERROR) Updating of the defect table failed after the successful sparing of the data sector.
39H	00H	<b>Saving Parameters Not Supported</b> (ILLEGAL REQUEST) Cannot save the specified parameters.
3AH	00H	<b>Medium Not Present</b> (NOT READY) No disk. Medium is not inserted into the drive unit.
3DH	00H	<b>Invalid Bits in Identify Message</b> (ILLEGAL REQUEST) Reserved bits in Identify Message is set to one.
3FH	00H	<b>Mode Parameter Changed</b> (UNIT ATTENTION) Mode Parameter has been changed.
40H	80H	<b>Bias Magnet Failure</b> (HARDWARE ERROR) The bias magnet of the drive has failed.
40H	81H	<b>Limited Laser Life</b> (HARDWARE ERROR) Over-current was detected in the laser diode or the laser power was below the lower limit.
40H	84H	<b>Temperature Alarm</b> (HARDWARE ERROR) Internal temperature of the drive exceeded the limit.
40H	85H	<b>Laser Failure</b> (HARDWARE ERROR) The LD function has failed.

<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
40H	87H	<b>Unusual Servo Signal (HARDWARE ERROR)</b> Unusual servo signal has been detected.
40H	88H	<b>Sensor Failure (HARDWARE ERROR)</b> Loading sensor failure was detected.
40H	90H	<b>DSP Diag Error (HARDWARE ERROR)</b> There was a diagnostic error in the DSP.
40H	91H	<b>12V Line Failure (HARDWARE ERROR)</b> 12V line has not been supplied.
40H	92H	<b>Media Type Recognition Error (HARDWARE ERROR)</b> Media type cannot be distinguished.
40H	95H	<b>Buffer Memory Test Error (HARDWARE ERROR)</b> There was an error in the buffer memory test which checks the entire memory space.
40H	97H	<b>DSP Communication Error (HARDWARE ERROR)</b> DSP communication has failed.
40H	98H	<b>DSP Down-Load Error (HARDWARE ERROR)</b> DSP down-load has failed.
40H	99H	<b>RAM Test Error (HARDWARE ERROR)</b> There was an error during the RAM test.
40H	9AH	<b>ODC Test Error (HARDWARE ERROR)</b> There was an error during the ODC test.
40H	9DH	<b>Focus bias Calibration Failure (HARDWARE ERROR)</b> An error occurred during the focus bias calibration.
43H	00H	<b>Message Error (ABORTED COMMAND)</b> The command is aborted because the initiator rejected the message from the drive by issuing the MESSAGE REJECT message
44H	00H	<b>Internal Target Failure (HARDWARE ERROR)</b> The drive detected an error related to the controller block hardware or firmware.

<b>ASC</b>	<b>ASCQ</b>	<b>Description</b>
45H	00H	<b>Reselection Time-out Error</b> (ABORTED COMMAND) The time has run out during the reselection phase.
47H	00H	<b>SCSI Parity Error</b> (ABORTED COMMAND) The command was aborted due to parity error on the SCSI bus.
48H	00H	<b>Initiator Detected Error Message Received</b> (ABORTED COMMAND) The command was aborted because the INITIATOR DETECTED ERROR message was sent from the initiator.
49H	00H	<b>Invalid Message Error</b> (ABORTED COMMAND) The command was aborted due to an inappropriate illegal message from the initiator.
4EH	00H	<b>Overlapped Commands Attempted</b> (ABORTED COMMAND) Initiator attempted to reconnect to an I/O process.
53H	00H	<b>Media Load/Eject Failure</b> (HARDWARE ERROR) Failure was detected during loading or unloading the cartridge.
53H	02H	<b>Medium Removal Prevented</b> (ILLEGAL REQUEST) Cartridge is prevented to be removed.
92H	00H	<b>Overwrite Attempted</b> (BLANK CHECK) The drive attempted to write data on the written block.
93H	00H	<b>Blank Sector Detected</b> (BLANK CHECK) Blank block was detected.
94H	00H	<b>Written Sector Detected</b> (BLANK CHECK) Written block was detected.

**FORMAT UNIT****04H****FUNCTION**

Initializes the optical disk.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (04H)							
1	Logical Unit Number			FmtData	CmpLst	Defect List Format		
2	Reserved					MkCDA	MkPlst	
3	Reserved							
4	Reserved							
5	Reserved	ErsCrtl	Reserved			Flag	Link	

**FmtData**

Format Data bit of 1 indicates that the FORMAT UNIT parameter list shall be transferred during the DATA OUT phase. The parameter list consists of a Defect List Header followed by zero or more Defect Descriptor(s). Format Data bit of 0 indicates that DATA OUT phase shall not occur. The source of defect information is not specified.

**CmpLst**

Complete List bit of 1 indicates that the previous GList is not applied to make the defect list. Complete List bit of 0 indicates that the previous GList is added to the defect list.

**Defect List Format**

Defect List Format can be either Block Format (0) or Physical Sector Format (5).

**MkCDA and MkPlst**

These bits have no effect on the drive.

**ErsCntr**

Erase Control bit of 0 indicates that ERASE operation is automatically performed before writing the data when the drive is directed to perform the certify operation by the initiator. Erase Control bit of 1 surpasses the ERASE operation.

The Defect List Format may be in Block Format or Physical Sector Format. FmtData, CmpLst and Defect List Format fields should be set as one of the following:

FmtData (bit 4)	CmpLst (bit 3)	Defect List Format			Description
		(bit 2)	(bit 1)	(bit 0)	
0	0	0	0	0	No Defect List Header and no Defect Descriptor
1	x	0	0	0	Block Format
1	x	1	0	1	Physical Sector Format
All other codes (x: arbitrary)					Reserved

Defect List Format of unformatted medium should be in the Physical Sector Format.

#### Write-Once medium

For Write-Once media, this command can be executed only once during the lifetime of the disk. When an initiator attempts to execute the Format Unit command more than once, CHECK CONDITION status is returned. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 05H/20H/00H (ILLEGAL REQUEST/Invalid Command Operation Code). Also, the Defect List Format should be in the Physical Sector Format.

#### **Note:**

When this command is issued while 600/650 Mbyte media and 1.2/1.3 Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

## FORMAT UNIT (04H)

When the FmtData bit is 1, the drive goes into DATA OUT phase and receives the Defect List from the initiator. The length of the Defect Descriptors varies with the format of the Defect List. The Defect List format is as follows:

Defect List Header																			
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0											
0	Reserved																		
1	FOV	DPRY	DCRT	Reserved			Immed	Reserved											
2	Defect List Length (MSByte)																		
3	Defect List Length (LSByte)																		
Defect Descriptor(s)																			
4	Defect Descriptor 1																		
m																			
m + 1	Defect Descriptor 2																		
n																			
•																			
•																			
•																			
p	Defect Descriptor i																		
q																			

### FOV

Format Options Valid bit of 1 indicates that the DPRY, DCRT and Immed bits contain valid information. Format Options Valid bit of 0 indicates that the DPRY, DCRT and Immed bits shall be in their default settings (all bits are set to zero).

### DPRY

This bit has no effect on the drive.

### DCRT

Disable Certification bit of 1 indicates that the drive does not certify the optical disk during the format process. Disable Certification bit of 0 indicates that the drive does certify the optical disk during the format process. When the FOV bit is set to 0, the DCRT bit must also be set to 0. DCRT does not apply to Write-Once disks.

**Immed**

Immediate bit of 1 indicates that status is returned as soon as the Command Descriptor Block has been validated. Immediate bit of 0 indicates that status is returned after command completion.

**Defect List Length**

Defect List Length is the total length of Defect Descriptors.

The followings are the formats of the Defect Descriptors:

**Physical Sector Format**

Byte	Defect Descriptor
0	Track Number of Defect (MSByte)
1	Track Number of Defect
2	Track Number of Defect(LSByte)
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Sector Number Defect

In the Physical Sector Format, the Track Number of Defect and Sector Number of Defect field indicate the physical track number and the physical sector number of the defect portion of the medium.

**Block Format**

Byte	Defect Descriptor
0	Reserved
1	Defect Block Address (MSByte)
2	Defect Block Address
3	Defect Block Address (LSByte)

In Block Format, the Defect Block Address field indicates the Logical Block Address of the defective sector. Logical Block Address is converted to physical track/sector by the drive according to the current format mode of the medium.

In both format cases, the defective sector lists have to be in ascending sector order.

**REASSIGN BLOCKS****07H****FUNCTION**

Reassigns the defective sectors. A defect list containing the Logical Block Address to be reassigned is transferred to the drive. Data in the defective sector is moved to the replacement sector.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
0	Operation Code (07H)												
1	Logical Unit Number			Reserved									
2	Reserved												
3	Reserved												
4	Reserved												
5	Reserved					Flag	Link						

Write-Once Medium

If this command is executed for a Write-Once medium, CHECK CONDITION status is returned. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 05H/20H/00H (ILLEGAL REQUEST/Invalid Command Operation Code).

**Note:**

When this command is issued while 600/650 Mbyte media and 1.2/1.3 Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

### Reassign Blocks Command Defect List

Reassign Blocks Command Defect List consists of four byte Defect List Header and zero or more Defect Descriptor(s) of size of four byte.

Defect List Header								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved							
1	Reserved							
2	Defect List Length (MSByte)							
3	Defect List Length (LSByte)							
Defect Descriptor(s)								
4	Defect Descriptor 1							
7								
8	Defect Descriptor 2							
11								
	•							
	•							
	•							
4 x i	Defect Descriptor i							
4 x i + 3								

### Defect List Length

Defect List Length specifies the total length of Defect Descriptors that follow the Defect List Header and expressed in bytes.

The format of Defect Descriptor is shown below:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Reserved
1								Defective Logical Block Address (MSByte)
2								Defective Logical Block Address
3								Defective Logical Block Address (LSByte)

The Defect Sector List should be allocated in ascending order.

**READ(6)****08H****FUNCTION**

Reads data from specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
0	Operation Code (08H)												
1	Logical Unit Number			Logical Block Address (MSByte)									
2	Logical Block Address												
3	Logical Block Address(LSByte)												
4	Transfer Length												
5	PBA	Reserved				Flag	Link						

**Transfer Length**

Transfer Length field specifies the number of contiguous logical blocks of data to be read.

Transfer Length of 0 specifies that 256 logical blocks are to be read. Any other value specifies the number of logical blocks to be read.

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. Physical Block Address will be given in the Logical Block Address field. Sector 0 of track 0 will always be set as Physical Block Address = 0. This bit of 0 indicates that logical block addressing is used.

**Note:**

When the drive is requested to read data on 2.3 Gbyte media, 4.1 Gbyte media and 4.8 Gbyte media, this command cannot handle Logical Block Address above 200,000 (1FFFFF H).

Unless the RC bit of the Read-Write Error Recovery Page (See the MODE SELECT command for more details) is set to 1, reading the data from the medium is corrected by Error Correction Code.

If a blank block is detected during the operation of this command, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/93H/00H (BLANK CHECK/Blank Sector Detected).

**WRITE(6)****0AH****FUNCTION**

Writes data to specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
0	Operation Code (0AH)												
1	Logical Unit Number			Logical Block Address (MSByte)									
2	Logical Block Address												
3	Logical Block Address(LSByte)												
4	Transfer Length												
5	PBA	ErsCtl	Reserved			Flag	Link						

**Transfer Length**

Transfer Length field specifies the number of contiguous Logical Blocks of data to be written. Transfer Length of 0 specifies that 256 Logical Blocks are to be written. Any other value specifies the number of Logical Blocks to be written.

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. Physical Block Address will be given in the Logical Block Address field. Sector 0 of track 0 will always be set as Physical Block Address = 0. This bit of 0 indicates that logical block addressing is used.

**ErsCtl**

If the Erase Control bit is set to 0, an ERASE operation is automatically performed before writing the data. Erase Control bit of 1 suppresses the ERASE operation.

**Write-Once Medium**

If a written block is detected during the operation of this command, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/92H/00H (BLANK CHECK/ Overwrite Attempted).

**Note:**

When the drive is requested to write data on 2.3 Gbyte media, 4.1 Gbyte media and 4.8 Gbyte media, this command cannot handle Logical Block Address above 200,000 (1FFFFF H).

Also, when this command is issued while 600/650 Mbyte media and 1.2/1.3 Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

**SEEK(6)****0BH****FUNCTION**

Moves the optical head to the physical track that address is specified in physical or logical address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
<b>0</b>	Operation Code (0BH)												
<b>1</b>	Logical Unit Number			Logical Block Address (MSByte)									
<b>2</b>	Logical Block Address												
<b>3</b>	Logical Block Address(LSByte)												
<b>4</b>	Reserved												
<b>5</b>	PBA	Reserved				Flag	Link						

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. Physical Block Address will be given in the Logical Block Address field. Sector 0 of track 0 will always be set as Physical Block Address = 0. This bit of 0 indicates that logical block addressing is used.

**Note:**

When the drive is requested to seek 2.3 Gbyte media, 4.1 Gbyte media and 4.8 Gbyte media, this command cannot handle Logical Block Address above 200,000 (1FFFFF H).

**INQUIRY****12H****FUNCTION**

Requests the drive to send information to the initiator.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Operation Code (12H)
1			Logical Unit Number					Reserved
2								Reserved
3								Reserved
4								Allocation Length
5							Flag	Link

**Allocation Length**

This field specifies the number of bytes that the initiator has allocated for the data to be returned. Allocation length of 0 is not an error and indicates that no data will be returned. The initiator will terminate the data-in-phase when all available inquiry data has been returned or when allocation length byte has been returned, either with less length.

If an INQUIRY command is received from an initiator with pending UNIT ATTENTION condition (before the drive reports CHECK CONDITION status), the drive performs the INQUIRY command and does not clear the UNIT ATTENTION condition.

The INQUIRY data is returned in the following format:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
0	Peripheral Qualifier			Peripheral Device Type							
1	RMB	Device Type Modifier									
2	ISO Version		ECMA Version			ANSI-Approved Version					
3	Response Data Format										
4	Additional Length (1FH)										
5	Reserved										
6	Reserved										
7	RelAdr	WBus32	WBus16	Sync	Linked	Reserved	CmdQue	SftRe			
8-15	Vendor Identification (in ASCII)										
16-31	Product Identification (in ASCII)										
32-35	Product Revision Level (in ASCII)										

#### **Peripheral Qualifier, Peripheral Device Qualifier**

Device Type will be set to 07H (Peripheral Qualifier and Peripheral Device Type will be set to 000b and 07H (Optical Memory Device)). If the Direct Access Inquiry Response (DAIR) bit of MODE SELECT command is set to 1, the Device Type will return 00H (Direct Access Device).

As the drive does not support Logical Unit Number 1 through 7, an INQUIRY command to the logical units with these numbers always returns 7FH (Peripheral Qualifier and Peripheral Device Type are set to 011b and 1FH (Unknown Device Type)).

#### **RMB**

Removable Medium Bit (RMB) of 1 indicates that the medium is removable. The drive only supports removable media, so this bit is always set to 1.

#### **Device Type Modifier**

The drive does not use this field currently, so this bit is set to 0.

#### **ISO Version, ECMA Version and ANSI-Approved Version**

The drive returns 2 for this field.

#### **Response Data Format**

The drive returns 2 for this field.

**Additional Length**

This field indicates the additional parameter length in bytes. This field always returns 31 (1FH).

The drive returns 9AH for the Byte 7:

<b>RelAdr</b>	Relative Addressing bit of 1 indicate that the drive supports the relative addressing mode.
<b>WBus32, WBus16</b>	Both Wide Bus 32 bit and Wide Bus 16 bit are 0 indicating that the drive only supports 8bit wide data transfers.
<b>Sync</b>	Synchronous Transfer bit of 1 indicates that the drive supports synchronous data transfer.
<b>Linked</b>	Linked Command bit of 1 indicates that the drive supports Linked command.
<b>CmdQue</b>	Command Queuing bit of 1 indicates that the drive supports tagged command queuing.
<b>SftRe</b>	Soft Reset bit of 0 indicates that the drive responds to RESET condition with hard RESET.

**Vendor Identification**

The drive returns "SONY" for this field.

**Product Identification**

This field indicates the product ID. Following ASCII strings are returned for each model.

Model Number	Product Identification
SMO-F551	" <b>SMO-F551</b> "

**Product Revision Level**

This field returns the current firmware version in "x.xx" in ASCII.

# MODE SELECT(6)

15H

## FUNCTION

MODE SELECT command sets the optical disk and drive parameters.

## CDB

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
0	Operation Code (15H)										
1	Logical Unit Number			PF	Reserved			SP			
2	Reserved										
3	Reserved										
4	Parameter List Length										
5	Reserved					Flag	Link				

### PF

Page Format bit of 0 indicates that all the parameters after the Block Descriptors are vendor-specific. This bit of 1 indicates that the parameters following the Header and Block Descriptor(s) are structured as specified in following pages.

Even the Page Format bit is set to 0, the drive will operate as this bit is set to 1.

### SP

Save Pages bit of 1 indicates that the drive performs the specified MODE SELECT operation and saves all the savable data to non-volatile storage. The data is saved only if it is different from those currently saved. Save Pages bit of 0 indicates that the drive performs the specified MODE SELECT operation and does not save any data.

### Parameter List Length

This field specifies the length of the MODE SELECT Parameter List that the initiator will transfer to the drive during the DATA OUT phase in bytes. Parameter List Length of 0 indicates that no data will be transferred. This condition is not considered as an error.

MODE SELECT Parameter List contains a four-byte header, followed by zero or one Block Descriptor and Pages.

The format of MODE SELECT Parameter List is as follows:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
<b>Mode Select Parameter Header</b>								
<b>0</b>	Reserved							
<b>1</b>	Medium Type							
<b>2</b>	Reserved							
<b>3</b>	Block Descriptor Length							
<b>Block Descriptor(s)</b>								
<b>4 - m</b>	Block Descriptor							
<b>Page(s)</b>								
<b>m - n</b>	Page							

### Medium Type

Although the Medium Type field has to be set to 00H, 02H or 03H, the selection of the type will not have any effect on the operation.

### Block Descriptor Length

Block Descriptor Length specifies the length of Block Descriptors in bytes. It shall be equal to the number of Block Descriptors times eight. Block Descriptor Length of 0 indicates that no Block Descriptor is included in the parameter list. This condition is not considered an error.

The form of Block Descriptor is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Density Code							
1	Number of Blocks (MSByte)							
2	Number of Blocks							
3	Number of Blocks (LSByte)							
4	Reserved							
5	Block Length (MSByte)							
6	Block Length							
7	Block Length(LSByte)							

All the fields in the Block Descriptor has no effect on the drive's operation.

Page format is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0						
0	Reserved		Page Code											
1	Page Length													
2 - n	Page Specific Parameters													

The drive supports the Pages under the following definition:

Page Code	Description
01H	Read-Write Error Recovery Page
02H	Disconnect-Reconnect Page
08H	Caching Page
0AH	Control Mode Page
0BH	Medium Types Supported Page
20H	Vendor Unique Format Page
21H	Vendor Unique Page

**01H Read-Write Error Recovery Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		Page Code (01H)					
1	Page Length (0AH)							
2	AWRE	Reserved	TB	RC	Reserved	PER	DTE	DCR
3	Read Retry Count							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Write Retry Count							
9	Reserved							
10	Reserved							
11	Reserved							

**AWRE**

Automatic Write Reallocation Enable bit of 1 enables the automatic reallocation of defective sector(s) upon medium error detection during the following commands:

- WRITE commands (0AH, 2AH, AAH)
- ERASE commands (2CH, ACH)
- WRITE AND VERIFY commands (2EH, AEH)
- WRITE LONG commands (3FH)

This bit of 0 indicates that the automatic reallocation will not be enabled and the drive will return an error code upon defective sector detection.

**Note:**

AWRE cannot be disabled on Write-Once media.

**TB**

Transfer Block bit of 1 indicates that a data block which is not recovered within the specified recovery limits is transferred to the initiator before CHECK CONDITION status is returned.

Transfer Block bit of 0 indicates that such a data block is not transferred to the initiator.

**RC**

Read Continuous bit of 1 indicates that the drive does not correct the error bytes by Error Correction Code and requests the drive to transfer the data without adding delay which would increase data integrity during the READ command. This bit being 0 allows the use of Error Correction Code.

**PER**

When Post Error bit is set to 1, the drive reports on recovered errors. This bit of 0 indicates there will be no reports on recovered errors.

**DTE**

Disable Transfer on Error bit of 1 indicates that the drive terminates the data phase upon detection of a recovered error. This bit of 0 indicates that the drive does not terminate the data phase upon detection of recovered error.

**DCR**

Disable Correction bit of 1 indicates that Error Correction Code is not used for data recovery. This bit of 0 allows the use of Error Correction Codes for data error recovery.

**Read Retry Count**

Read Retry Count field specifies how many times the drive retries the READ operation before it reports an error to the initiator.

**Write Retry Count**

Write Retry Count field specifies how many times the drive retries the WRITE operation before it reports an error to the initiator.

**02H Disconnect-Reconnect Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved							Page Code (02H)
1								Page Length (0EH)
2								Buffer Full Ratio
3								Buffer Empty Ratio
4-9								Reserved
10								Maximum Burst Size (MSByte)
11								Maximum Burst Size (LSByte)
12-15								Reserved

Disconnect-Reconnect page provides requests the initiator to tune the performance of the SCSI bus.

**Buffer Full Ratio, Buffer Empty Ratio**

Buffer Full Ratio and Buffer Empty Ratio field indicate how much buffer space should be available prior to attempting a reselection. Targets which do not support the requested ratio will round the number to the implemented ratio.

These fields have no effect on the drive.

**Maximum Burst Size**

This field indicates the maximum amount of data that the drive transfers during the data phase before disconnecting which the initiator has granted. This field shall be expressed in increments of 512 bytes. (e.g. one means 512 bytes, two means 1024 bytes, and so on.) Field value of zero indicates that there is no limit on the amount of data to be transferred per connection.

**08H Caching Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved						Page Code (08H)	
1			Page Length (0AH)					
2			Reserved				WCE	MF
3			Reserved					
4			Disable Pre-Fetch Transfer Length (MSByte)					
5			Disable Pre-Fetch Transfer Length (LSByte)					
6			Minimum Pre-Fetch (MSByte)					
7			Minimum Pre-Fetch (LSByte)					
8			Maximum Pre-Fetch (MSByte)					
9			Maximum Pre-Fetch (LSByte)					
10			Maximum Pre-Fetch Ceiling (MSByte)					
11			Maximum Pre-Fetch Ceiling (LSByte)					

**WCE**

Write Cache Enable bit of 1 indicates that the write cache is enabled. Otherwise, this bit being 0 means the write cache is disabled. This bit has the priority over the functional switch setting when the MODE SELECT command is requested.

**RCD**

Read Cache Disable bit of 1 indicates that the read cache is disabled. Otherwise, this bit being 0 means the read cache is enabled.

The operation of Write Cache Enable (WCE) Bit and Read Cache Disable (RCD) Bit is as follows:

WCE	RCD	write cache	read cache
0	0	disable	enable
1 (default)	0 (default)	enable	enable
0	1	disable	disable

If both WCE and RCD bits are set to 1, WCE bit will be automatically changed to 0.

The following five fields exist for compatibility and do not have any means of the operation of the drive:

**MF**

**Pre-Fetch Transfer Length**

**Minimum Pre-Fetch**

**Maximum Pre-Fetch**

**Maximum Pre-fetch Ceiling**

**0AH Control Mode Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved							Page Code (0AH)
1								Page Length (06H)
2				Queue Algorithm Modifier				Reserved
3				Reserved			QErr (0)	DQue
4-7					Reserved			

**Queue Algorithm Modifier**

Queue Algorithm Modifier field specifies restrictions on the algorithm used for reordering commands that are tagged with the SIMPLE QUEUE TAG message. Queue Algorithm Modifier field is as follows:

Value	Definition
0h	Restricted reordering
1h	Unrestricted reordering allowed
2h ~ Fh	Reserved

A value of 0 in this field specifies that the drive shall order the actual execution sequence of the commands with the SIMPLE QUEUE TAG such that data integrity is maintained for the initiator. A value of 1 specifies that the drive may order the actual execution sequence of the commands with the SIMPLE QUEUE TAG in any manner.

**QErr**

Queue Error management bit of 0 indicates that remaining suspended I/O process shall resume after the contingent allegiance condition.

The default value of this bit is 0 and cannot be changed.

**DQue**

Disable Queuing bit of 0 indicates that the tagged command queuing is enabled. This bit of 1 indicates that the tagged command queuing is disabled.

**0BH Medium Type Supported Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved							Page Code (0BH)
1								Page Length (06H)
2								Reserved
3								Reserved
4								Medium Type 1 Supported
5								Medium Type 2 Supported
6								Medium Type 3 Supported
7								Medium Type 4 Supported

This page sets the supported medium type(s). The medium type supported by the drive is indicated from Medium Type 1 Supported field to Medium Type 4 Supported field. The drive accepts the following combination:

Byte	Field Name	Setting 1	Setting 2 (default)	Setting 3	Setting 4
4	Medium Type 1 Supported	00H	02H	02H	03H
5	Medium Type 2 Supported	00H	03H	00H	00H
6	Medium Type 3 Supported	00H	00H	00H	00H
7	Medium Type 4 Supported	00H	00H	00H	00H

00H Default (only one medium type supported. )

02H Write-Once medium

03H Rewritable medium

Only rewritable medium can be used at settings 1 and 4. Both rewritable and Write-Once medium can be used at setting 2 (default). Only Write-Once medium can be used at setting 3.

**20H Vendor Unique Format Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved				Page Code (20H)			
1				Page Length (0AH)				
2				Format Mode				
3-11				Format Type Specific Data				

The drive supports the Format Mode 03H and 04H. Format Mode 03H is for 650 Mbyte/cartridge medium, and Format Mode 04H is for 1.2/1.3, 2.3/2.6 and 4.1/4.8/5.2 Gbyte/cartridge medium.

**Format Mode 03H**

Format Mode 03H supports two types of format (type 0 and type 1 by setting Byte 3).

**Format Mode 03H - Type 0**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2				Format Mode (03H)				
3				Type (00H)				
4			Size of User Band (MSByte)					
5			Size of User Band					
6			Size of User Band					
7			Size of User Band (LSByte)					
8			Size of Spare Band (MSByte)					
9			Size of Spare Band (LSByte)					
10			Number of Bands (MSByte)					
11			Number of Bands (LSByte)					

**Size of User Band**

This field indicates the length of each user band in number of logical blocks.

**Size of Spare Band**

This field indicates the length of each spare band in number of logical blocks.

**Number of Bands**

This field indicates the number of bands on the media. The drive can READ and WRITE multi-bands formatted medium. (For 650 Mbyte media, the drive can only READ.)

**Format Mode 03H - Type 1**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2								Format Mode (03H)
3								Type (01H)
4								Reserved
5								Reserved
6								Number of Bands (MSByte)
7								Number of Bands (LSByte)
8								Size of Spare Band (MSByte)
9								Size of Spare Band (LSByte)
10								Reserved
11								Reserved

Type 1 format exists for compatibility.

**Format Mode 04H**

Format Mode 04H is for 1.3 and 2.6 Gbytes/cartridge medium.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2								Format Mode (04H)
3								Reserved
4								Reserved
5								Reserved
6								Reserved
7								Reserved
8								Reserved
9								Reserved
10								Number of Bands (MSByte)
11								Number of Bands (LSByte)

For each type of media, the number of Bands field shall be as shown in table.

<b>Gbyte/cartridge</b>	<b>The number of Bands field</b>
1.2/1.3GB	1(01H) or 16(10H)
2.3GB	30(1EH)
2.6GB	34(22H)
4.1GB	38(26H)
4.8GB	45(2DH)
5.2GB	24(18H)

**21H Vendor Unique Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
<b>0</b>	Reserved		Page Code (21H)					
<b>1</b>	Page Length (0AH)							
<b>2</b>	Reserved							DAIR
<b>3</b>	DWR	Quick Disconnect	Reserved	Force Verify	DRBCHK	Reserved		
<b>4</b>	S1 - 8	S1 - 7	S1 - 6	S1 - 5	S1 - 4	S1 - 3	S1 - 2	S1 - 1
<b>5</b>	S2 - 8	S2 - 7	S2 - 6	S2 - 5	S2 - 4	S2 - 3	S2 - 2	S2 - 1
<b>6</b>	Reserved							
<b>7</b>	Reserved							
<b>8</b>	Reserved							
<b>9</b>	Reserved							
<b>10</b>	Reserved							
<b>11</b>	Reserved							

**DAIR**

Direct Access Inquiry Response bit of 1 indicates the Peripheral Device Type field in the Inquiry Data indicates "Direct Access Device." Direct Access Inquiry Response bit of 0 indicates the Peripheral Device Type field indicates "Optical Memory Device."

**DWR**

Disable Write Reordering bit of 1 indicates write reordering is disabled. Disable Write Reordering bit of 0 indicates write reordering is enabled.

**Quick Disconnect**

Quick Disconnect bit of 1 enables SCSI bus disconnection before command validation on media access commands (i.e. read, write). This bit of 0 disables SCSI bus disconnection before command validation on media access commands.

**Force Verify**

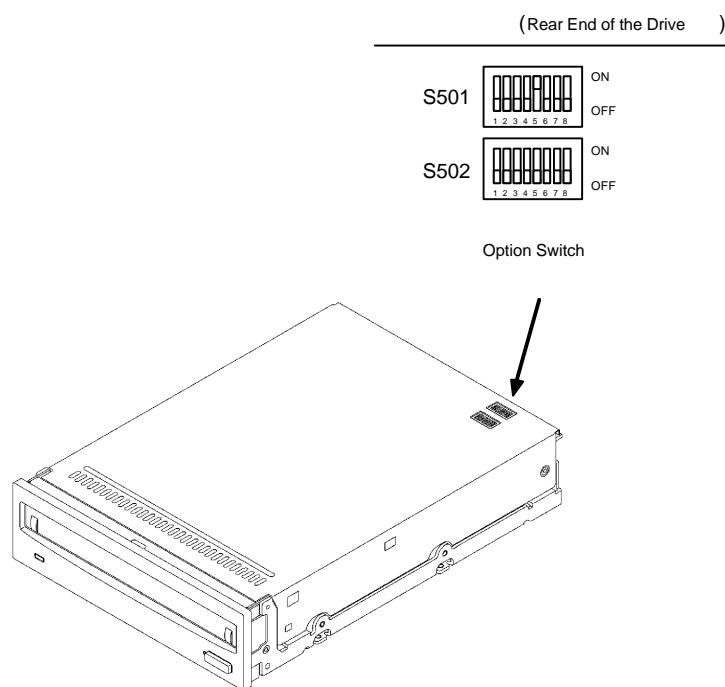
Force Verify bit of 1 indicates that all write operations will be verified. Write 6, 10 and 12-byte commands will operate as if they are Write Verify 6, 10 and 12-byte commands. This bit of 0 indicates normal operations.

**DRBCHK**

Disable Read Blank Check bit of 1 indicates that there will be no blank check following a Read Error, and vice versa. For CCW media, the drive will perform a blank check no matter what this bit is set to.

**SX - Y**

These bits represent the DIP switch "S50X - Y." They are only meaningful on MODE SENSE command. Although these bits may set to any number, they will have no effect on the drive.



**Default Values of Mode Page Parameters**

Page	Field	Default value
01H	AWRE	1
01H	TB	0
01H	RC	0
01H	PER	0
01H	DTE	0
01H	DCR	0
01H	Read Retry Count	05H
01H	Write Retry Count	05H
02H	Buffer Empty Ratio	
20H		
02H	Buffer Full Ratio	20H
02H	Maximum Burst Size	0020H
08H	WCE	1
08H	MF	1
08H	RCD	0
08H	Disable Pre-fetch Transfer Length	40H
08H	Minimum Pre-fetch	01H
08H	Maximum Pre-fetch	01H
08H	Maximum Pre-fetch Ceiling	40H
0AH	Queue Algorithm Modifier	0
0AH	QErr	0
0AH	DQue	0
0BH	Medium Type 1 Supported	02H
0BH	Medium Type 2 Supported	03H
0BH	Medium Type 3 Supported	00H
0BH	Medium Type 4 Supported	00H
21H	DAIR	0
21H	DWR	0
21H	Quick Disconnect	0
21H	Force Verify	0
21H	DRBCHK	0

These values are set as current values when Power-On reset, SCSI bus reset occurs or BUS DEVICE RESET message is received.

Default values and current values of format page (20H) are set upon reset of media loading as follows:

650 Mbyte/cartridge media:

<b>Page</b>	<b>Field</b>	<b>Default Value</b>	<b>Current Value</b>
20H  (Non-formatted media)	Format Mode	3	3
	Type	0	0
	Number of Bands	1	1
	Size of Spare Band	2048	2048
	Number of Bands	1	-
	Size of Spare Band	2048	-

(For formatted media) Number of Bands and Size of Spare Band previously set upon formatting will be set as current values. Only when the media is unformatted, these current values will be set as the default setting.

1.2/1.3 Gbyte/cartridge (512/1024 byte/sector) media:

<b>Page</b>	<b>Field</b>	<b>Default Value</b>	<b>Current Value</b>
20H  (Non-formatted media)	Format Mode	4	4
	Number of Bands	1	1
	Number of Bands	1	1 or 16

(For formatted media) Number of Bands previously set upon formatting (either 1 or 16) will be set as current value. Only when the media is unformatted, these current values will be set as the default setting.

MODE SELECT(6) (15H)

2.3 Gbytes/cartridge (512 bytes/sector) media:

Page	Field	Default Value	Current Value
20H	Format Mode	4	4
	Number of Bands	30	30

2.6 Gbytes/cartridge (1024 bytes/sector) media

Page	Field	Default Value	Current Value
20H	Format Mode	4	4
	Number of Bands	34	34

4.1 Gbytes/cartridge (512 bytes/sector) media

Page	Field	Default Value	Current Value
20H	Format Mode	4	4
	Number of Bands	38	38

4.8 Gbytes/cartridge (1024 bytes/sector) media

Page	Field	Default Value	Current Value
20H	Format Mode	4	4
	Number of Bands	45	45

5.2 Gbytes/cartridge (2048 bytes/sector) media

Page	Field	Default Value	Current Value
20H	Format Mode	4	4
	Number of Bands	24	24

**RESERVE****16H****FUNCTION**

Gains the priority to control the drive when the drive is connected to multiple initiators.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
<b>0</b>	Operation Code (16H)										
<b>1</b>	Logical Unit Number			3rdPty	Third Party Device ID			Reserved			
<b>2</b>	Reserved										
<b>3</b>	Reserved										
<b>4</b>	Reserved										
<b>5</b>	Reserved					Flag	Link				

The reservation is effective until one of the following occurs:

1. The reserved initiator sends another valid RESERVE command.
2. The reserved initiator is released by a RELEASE command.
3. Any initiator sends a BUS DEVICE RESET message.
4. RESET condition occurs.

If any other initiator attempts to perform any command on the reserved logical unit other than INQUIRY REQUEST SENSE, and PREVENT/ALLOW MEDIUM REMOVAL (with a prevent bit of zero), or RELEASE command then the command shall be rejected with RESERVATION CONFLICT status.

**3rdPty**

Third Party bit of 1 indicates that the drive is reserved for the SCSI device specified in the Third Party Device ID field. Third Party bit of 0 indicates that a third party reservation is not requested.

**Third Party Device ID**

This field specifies the device ID for the third party reservation.

**RELEASE****17H****FUNCTION**

RELEASE command is sent by the reserving initiator to release the drive for a use by another initiator.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
0	Operation Code (17H)										
1	Logical Unit Number			3rdPty	Third Party Device ID			Reserved			
2	Reserved										
3	Reserved										
4	Reserved										
5	Reserved					Flag	Link				

**3rdPty**

Third Party bit of 1 indicates that the drive is to be released only by the initiator which reserved the drive using the third party reservation prior to this RELEASE option. This bit being 0 indicates that the Third Party Release is not requested.

**Third Party Device ID**

This field specifies the device ID for the third party release.

**MODE SENSE(6)****1AH****FUNCTION**

Acquires the parameters of medium, drive and drive controller.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0									
0	Operation Code (1AH)																
1	Logical Unit Number			Reserved	DBD	Reserved											
2	PC		Page Code														
3	Reserved																
4	Allocation Length																
5	Reserved						Flag	Link									

**DBD**

Disable Block Descriptors bit of 1 indicates that the Block Descriptor is not provided. On the other hand, this bit being 0 indicates that the Block Descriptor is provided.

**PC**

Page Control field defines the type of parameter values to be returned as follows:

bit 7	bit 6	type of parameter values
0	0	Current Values
0	1	Changeable Values
1	0	Default Values
1	1	Saved Values

**Page Code**

Page Code values are the same as for Mode Select command. If 00H or 3FH is specified, all the pages are returned.

**Allocation Length**

This field specifies the number of bytes that the initiator has allocated for the return of this data. Allocation Length bit of 0 indicates that there will be no returning data. This condition is not considered as an error. The drive will terminate the data-in-phase either when the Allocation Length has been transferred or when all the available data has been transferred to the initiator, whichever with less length.

The format of the MODE SENSE data is as follows:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-3	MODE SENSE Parameter Header							
0-7	Block Descriptor (if any)							
0-n	Page(s)							

The MODE SENSE Parameter Header is defined in following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Mode Data Length							
1	Medium Type							
2	WP	Reserved	DPOFUA	Reserved				
3	Block Descriptor Length							

### Mode Data Length

This field specifies the length of the following MODE SENSE data in bytes.

### Medium Type

Medium Type field will return 00H (default: only one medium type to be supported), 02H (Write-Once medium), or 03H (rewritable medium) depending on the drive condition. It will return 00H for no disk or not ready condition and 02H or 03H if it is ready to access the medium. Medium Type field always return 00H if Medium Type 1 Supported to Medium Type 4 Supported field of Page 0BH is all set to 00H.

### WP

Write Protect bit of 1 indicates that the optical disk in the drive is write protected. This bit of 0 indicates the disk is not write protected.

### DPOFUA

This bit indicates DPO/FUA (DPO: Disable Page Out, FUA: Force Unit Access) is supported or not. This bit being 1 indicates DPO/FUA flag is supported. This bit being 0 indicates DPO/FUA is not supported. This bit is fixed to be 1.

### Block Descriptor Length

Block Descriptor Length field specifies the length of the Block Descriptor in bytes. This field returns eight when DBD bit is 0. Otherwise, this field returns zero.

The format of Block Descriptor is show in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0					Density Code			
1					Number of Blocks (MSByte)			
2					Number of Blocks			
3					Number of Blocks (LSByte)			
4					Reserved			
5					Block Length (MSByte)			
6					Block Length			
7					Block Length (LSByte)			

### Density Code

Density Code field will return the following code depending on the inserted media:

Density Code	Media Type
03H	650 Mbyte/cartridge
0AH	1.3 Gbyte/cartridge
00H	2.6 Gbyte/cartridge
00H	5.2 Gbyte/cartridge

### Number of Blocks

This field specifies the number of logical blocks on the medium.

### Block Length

This field specifies the length of each logical block in bytes .

**01H Read-Write Error Recovery Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	C	D
<b>0</b>	PS (1)	Reserved	Page Code (01H)						na	na
<b>1</b>	Page Length (0AH)								na	na
<b>2</b>	AWRE	Reserved	TB	RC	Reserved	PER	DTE	DCR	B7	80
<b>3</b>	Read Retry Count						FF 05			
<b>4</b>	Reserved						00 00			
<b>5</b>	Reserved						00 00			
<b>6</b>	Reserved						00 00			
<b>7</b>	Reserved						00 00			
<b>8</b>	Write Retry Count						FF 05			
<b>9</b>	Reserved						00 00			
<b>10</b>	Reserved						00 00			
<b>11</b>	Reserved						00 00			

Changeable or default field values are returned to the host upon the request indicated by the PC field of CDB. In the above page table, column C indicates changeable values and column D indicates default values of each byte.

**PS**

Parameter Savable bit of 1 will be returned indicating this parameter page is savable in non-volatile RAM.

**AWRE**

Automatic Write Reallocation Enable bit of 1 indicates that the automatic reallocation of defective sector(s) upon medium error detection are enabled during the following commands:

- WRITE commands (0AH, 2AH, AAH)
- ERASE commands (2CH, ACH)
- WRITE AND VERIFY commands (2EH, AEH)
- WRITE LONG commands (3FH, DFH)

This bit of 0 indicates that the automatic reallocation is not enabled and the drive will return an error code upon defective sector detection.

**Note:**

AWRE is not disabled on Write-Once media.

**TB**

Transfer Block bit of 1 indicates that a data block which is not recovered within the specified recovery limits is transferred to the initiator before CHECK CONDITION status is returned. Transfer Block bit of 0 indicates that such a data block is not transferred to the initiator.

**RC**

Read Continuous bit of 1 indicates that the drive does not correct the error bytes by Error Correction Code and requests the drive to transfer the data without adding delay which would increase data integrity during the READ command. This bit being 0 indicates that the drive is allowed to use the Error Correction Code.

**PER**

When Post Error bit returns 1, the drive reports on recovered errors. This bit of 0 indicates there will be no reports on recovered errors.

**DTE**

Disable Transfer on Error bit of 1 indicates that the drive terminates the data phase upon detection of a recovered error. This bit of 0 indicates that the drive does not terminate the data phase upon detection of recovered error.

**DCR**

Disable Correction bit of 1 indicates that Error Correction Code is not used for data recovery. This bit of 0 means the drive is allowed to use the Error Correction Codes for data error recovery.

**Read Retry Count**

Read Retry Count field specifies how many times the drive retries the READ operation before it reports an error to the initiator.

**Write Retry Count**

Write Retry Count field specifies how many times the drive retries the WRITE operation before it reports an error to the initiator.

**02H Disconnect-Reconnect Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	C	D
<b>0</b>	PS (1)	Reserved	Page Code (02H)						na	na
<b>1</b>	Page Length (0EH)						na		na	na
<b>2</b>	Buffer Full Ratio						FF		20	
<b>3</b>	Buffer Empty Ratio						FF		20	
<b>4-9</b>	Reserved						00		00	
<b>10</b>	Maximum Burst Size (MSByte)						FF		00	
<b>11</b>	Maximum Burst Size (LSByte)						FF		20	
<b>12-15</b>	Reserved						00		00	

Changeable or default field values are returned to the host upon the request indicated by the PC bit of CDB. In the above page table, column C indicates changeable values and column D indicates default values of each byte.

Disconnect-Reconnect page provides requests the initiator to tune the performance of the SCSI bus.

**PS**

Parameter Savable bit of 1 will be returned indicating this parameter page is savable in non-volatile RAM.

**Buffer Full Ratio and Buffer Empty Ratio**

The Buffer Full Ratio and Buffer Empty Ratio field indicate how much buffer space should be available prior to attempting a reselection.

**Maximum Burst Size**

This field indicates the maximum amount of data that the drive transfers during the data phase before disconnecting which the initiator has granted. This field is expressed in increments of 512 bytes. (e.g. one means 512 bytes, two means 1024 bytes, and so on.) Field value of zero indicates that there is no limit on the amount of data to be transferred per connection.

**08H Caching Page**

<b>Byte</b>	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>	<b>C</b>	<b>D</b>
<b>0</b>	PS (1)	Reserved							na	na
<b>1</b>									na	na
<b>2</b>					Reserved	WCE	MF	RCD	07	06
<b>3</b>									00	00
<b>4</b>					Disable Pre-Fetch Transfer Length (MSByte)				FF	00
<b>5</b>						Disable Pre-Fetch Transfer Length (LSByte)			FF	40
<b>6</b>						Minimum Pre-Fetch (MSByte)			FF	00
<b>7</b>						Minimum Pre-Fetch (LSByte)			FF	01
<b>8</b>						Maximum Pre-Fetch (MSByte)			FF	00
<b>9</b>						Maximum Pre-Fetch (LSByte)			FF	01
<b>10</b>						Maximum Pre-Fetch Ceiling (MSByte)			FF	00
<b>11</b>						Maximum Pre-Fetch Ceiling (LSByte)			FF	40

Changeable or default field values are returned to the host upon the request indicated by the PC bit of CDB. In the above page table, column C indicates changeable values and column D indicates default values of each byte.

**PS**

Parameter Savable bit of 1 will be returned indicating this parameter page is savable in non-volatile RAM.

**WCE**

Write Cache Enable bit of 1 indicates that the write cache is enabled. This bit being 0 means the write cache is disabled. This bit has the priority over the functional switch setting when the MODE SELECT command is requested.

**RCD**

Read Cache Disable bit of 1 indicates that the read cache is disabled. This bit being 0 means the read cache is enabled.

## MODE SENSE(6) (1AH)

The operation of Write Cache Enable (WCE) Bit and Read Cache Disable (RCD) Bit is as follows:

<b>WCE</b>	<b>RCD</b>	<b>write cache</b>	<b>read cache</b>
0	0	disable	enable
1 (default)	0 (default)	enable	enable
0	1	disable	disable

If both WCE and RCD bits are set to 1, WCE bit will be automatically changed to 0.

The following five fields exist for compatibility and do not have any means of the operation of the drive:

### **MF**

#### **Pre-Fetch Transfer Length**

#### **Minimum Pre-Fetch**

#### **Maximum Pre-Fetch**

#### **Maximum Pre-fetch Ceiling**

**0AH Control Mode Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	C	D
0	PC (1)	Reserved	Page Code (0AH)						na	na
1	Page Length (06H)								na	na
2	Queue Algorithm Modifier				Reserved				00	00
3	Reserved				QErr (0)	DQue		01	00	
4-7	Reserved								00	00

Changeable or default field values are returned to the host upon the request indicated by the PC bit of CDB. In the above page table, column C indicates changeable values and column D indicates default values of each byte.

**PS**

Parameter Savable bit of 1 will be returned indicating this parameter page is savable in non-volatile RAM.

**Queue Algorithm Modifier**

Queue Algorithm Modifier field specifies restrictions on the algorithm used for reordering commands that are tagged with the SIMPLE QUEUE TAG message. Queue Algorithm Modifier field is as follows:

Value	Definition
0h	Restricted reordering
1h	Unrestricted reordering allowed
2h ~ Fh	Reserved

A value of 0 in this field specifies that the drive shall order the actual execution sequence of the commands with the SIMPLE QUEUE TAG such that data integrity is maintained for the initiator. A value of 1 specifies that the drive may order the actual execution sequence of the commands with the SIMPLE QUEUE TAG in any manner.

**QErr**

Queue Error management bit of 0 will be returned indicating that remaining suspended I/O process shall resume after the contingent allegiance condition.

**DQue**

Disable Queuing bit of 0 indicates that the tagged command queuing is enabled. This bit of 1 indicates that the tagged command queuing is disabled.

**0BH Medium Type Supported Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	C	D		
<b>0</b>	PS (1)	Reserved	Page Code (0BH)						na	na		
<b>1</b>	Page Length (06H)								na	na		
<b>2</b>	Reserved								00	00		
<b>3</b>	Reserved								00	00		
<b>4</b>	Medium Type 1 Supported								FF	02		
<b>5</b>	Medium Type 2 Supported								FF	03		
<b>6</b>	Medium Type 3 Supported								FF	00		
<b>7</b>	Medium Type 4 Supported								FF	00		

Changeable or default field values are returned to the host upon the request indicated by the PC bit of CDB. In the above page table, column C indicates changeable values and column D indicates default values of each byte.

**PS**

Parameter Savable bit of 1 will be returned indicating this parameter page is savable in non-volatile RAM.

This page sets the supported medium type(s). The medium type supported by the drive is indicated from Medium Type 1 Supported field to Medium Type 4 Supported field. The drive shall return one of the following combination:

Byte	Field Name	Setting 1	Setting 2 (default)	Setting 3	Setting 4
<b>4</b>	Medium Type 1 Supported	00H	02H	02H	03H
<b>5</b>	Medium Type 2 Supported	00H	03H	00H	00H
<b>6</b>	Medium Type 3 Supported	00H	00H	00H	00H
<b>7</b>	Medium Type 4 Supported	00H	00H	00H	00H

00H Default (only one medium type supported. )

02H Write-Once medium

03H Rewritable medium

Only rewritable medium will be used at settings 1 and 4. Both rewritable and Write-Once medium will be used at setting 2 (default). Only Write-Once medium will be used at setting 3.

**20H Vendor Unique Format Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	C	D
0	PS (1)	Reserved	Page Code (20H)						na	na
1	Page Length (0AH)						na		na	na
2	Format Mode						FF		-	
3-11	Format Type Specific Data						FF		-	

Changeable or default field values are returned to the host upon the request indicated by the PC bit of CDB. In the above page table, column C indicates changeable values and column D indicates default values of each byte.

**PS**

Parameter Savable bit of 1 will be returned indicating this parameter page is saved on the media upon formatting.

Format Mode 03H is for 650 Mbytes/cartridge medium, and Format Mode 04H is for 1.3, 2.6 and 5.2 Gbytes/cartridge medium.

**Format Mode 03H**

Format Mode 03H supports two types of format (type 0 and type 1 set by Byte 3).

**Format Mode 03H - Type 0**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2								Format Mode (03H)
3								Type (00H)
4								Size of User Band (MSByte)
5								Size of User Band
6								Size of User Band
7								Size of User Band (LSByte)
8								Size of Spare Band (MSByte)
9								Size of Spare Band (LSByte)
10								Number of Bands (MSByte)
11								Number of Bands (LSByte)

**Size of User Band**

This field indicates the length of each user band in number of blocks. The default value for 512 kByte/sector media is 576999. And the default value for 1024 kByte/sector is 314569.

**Size of Spare Band**

This field indicates the length of each spare band in number of blocks.

**Number of Bands**

This field indicates the number of bands on the media.

**Format Mode 03H - Type 1**

<b>Byte</b>	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>
<b>2</b>								Format Mode (03H)
<b>3</b>								Type (01H)
<b>4</b>								Reserved
<b>5</b>								Reserved
<b>6</b>								Number of Bands (MSByte)
<b>7</b>								Number of Bands (LSByte)
<b>8</b>								Size of Spare Band (MSByte)
<b>9</b>								Size of Spare Band (LSByte)
<b>10</b>								Reserved
<b>11</b>								Reserved

Type 1 format exists for compatibility.

**Format Mode 04H**

Format Mode 04H is for 1.3, 2.6 and 5.2 Gbytes/cartridge medium.

<b>Byte</b>	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>
<b>2</b>								Format Mode (04H)
<b>3</b>								Reserved
<b>4</b>								Reserved
<b>5</b>								Reserved
<b>6</b>								Reserved
<b>7</b>								Reserved
<b>8</b>								Reserved
<b>9</b>								Reserved
<b>10</b>								Number of Bands (MSByte)
<b>11</b>								Number of Bands (LSByte)

For 1.3 Gbyte media, the number of Bands field will return either 1(01H),16(10H). This field will return 30(1EH) for 2.3 Gbyte media (512 byte/sector) and 34(22H) for 2.6 Gbyte media (1024 byte /sector). And this filed will return 38(26H) for 4.1 Gbyte media (512 byte/sector), 45(20H) for 4.8 Gbyte media (1024 byte/sector) and 24(18H) for 5.2 Gbyte (2048 byte/sector).

## MODE SENSE(6) (1AH)

Default values and current values of format page (20H) are set upon reset or media loading as follows:

650 Mbyte/cartridge media:

Page	Field	Default Value	Current Value
20H  (Non-formatted media)	Format Mode	3	3
	Type	0	0
	Number of Bands	1	1
	Size of Spare Band	2048	2048
	Number of Bands	1	-
	Size of Spare Band	2048	-

(For formatted media) Number of Bands and Size of Spare Band previously set upon formatting will be set as current values. Only when the media is unformatted, these current values will be set as the default setting.

1.2/1.3 Gbyte/cartridge (512/1024 byte/sector) media:

Page	Field	Default Value	Current Value
20H  (Non-formatted media)	Format Mode	4	4
	Number of Bands	1	1
	Number of Bands	1	1 or 16

(For formatted media) Number of Bands previously set upon formatting (either 1 or 16) will be set as current value. Only when the media is unformatted, these current values will be set as the default setting.

2.3 Gbytes/cartridge (512 bytes/sector) media:

<b>Page</b>	<b>Field</b>	<b>Default Value</b>	<b>Current Value</b>
20H	Format Mode	4	4
	Number of Bands	30	30

2.6 Gbytes/cartridge (1024 bytes/sector) media

<b>Page</b>	<b>Field</b>	<b>Default Value</b>	<b>Current Value</b>
20H	Format Mode	4	4
	Number of Bands	34	34

4.1 Gbytes/cartridge (512 bytes/sector) media

<b>Page</b>	<b>Field</b>	<b>Default Value</b>	<b>Current Value</b>
20H	Format Mode	4	4
	Number of Bands	38	38

4.8 Gbytes/cartridge (1024 bytes/sector) media

<b>Page</b>	<b>Field</b>	<b>Default Value</b>	<b>Current Value</b>
20H	Format Mode	4	4
	Number of Bands	45	45

5.2 Gbytes/cartridge (2048 bytes/sector) media

<b>Page</b>	<b>Field</b>	<b>Default Value</b>	<b>Current Value</b>
20H	Format Mode	4	4
	Number of Bands	24	24

**21H Vendor Unique Page**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	C	D
<b>0</b>	PS (1)	Reserved	Page Code (21H)						na	na
<b>1</b>	Page Length (0AH)								na	na
<b>2</b>	Reserved						DAIR	01	00	
<b>3</b>	DWR	Quick Disconnect	Reserved	Force Verify	DRBCHK	Reserved			D8	00
<b>4</b>	S1 - 8	S1 - 7	S1 - 6	S1 - 5	S1 - 4	S1 - 3	S1 - 2	S1 - 1	FF	00
<b>5</b>	S2 - 8	S2 - 7	S2 - 6	S2 - 5	S2 - 4	S2 - 3	S2 - 2	S2 - 1	FF	00
<b>6</b>	Reserved						00		00	
<b>7</b>	Reserved						00		00	
<b>8</b>	Reserved						00		00	
<b>9</b>	Reserved						00		00	
<b>10</b>	Reserved						00		00	
<b>11</b>	Reserved						00		00	

Changeable or default field values are returned to the host upon the request indicated by the PC bit of CDB. In the above page table, column C indicates changeable values and column D indicates default values of each byte.

**PS**

Parameter Savable bit of 1 will be returned indicating this parameter page is savable in non-volatile RAM.

**DAIR**

Direct Access Inquiry Response bit of 1 indicates the Peripheral Device Type field in the Inquiry Data indicates "Direct Access Device." Direct Access Inquiry Response bit of 0 indicates the Peripheral Device Type field indicates "Optical Memory Device."

**DWR**

Disable Write Reordering bit of 1 indicates write reordering is disabled. Disable Write Reordering bit of 0 indicates write reordering is enabled.

### Quick Disconnect

Quick Disconnect bit of 1 enables SCSI bus disconnection before command validation on media access commands (i.e. read, write). This bit of 0 disables SCSI bus disconnection before command validation on media access commands.

### Force Verify

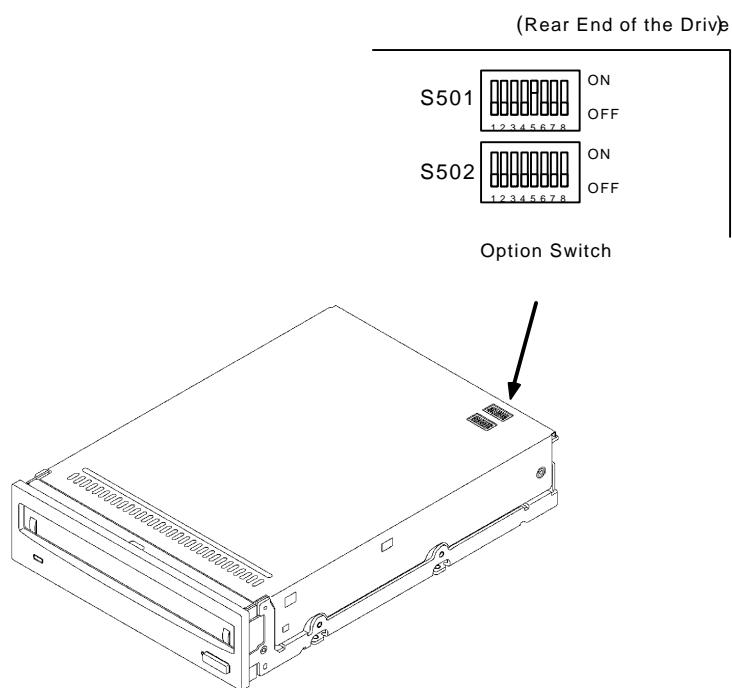
Force Verify bit of 1 indicates that all write operations will be verified. Write 6, 10 and 12-byte commands will operate as if they are Write Verify 6, 10 and 12-byte commands. This bit of 0 indicates normal operations.

### DRBCHK

Disable Read Blank Check bit of 1 indicates that there will be no blank check following a Read Error. This bit of 0 indicates that there will be a blank check after a Read Error. For CCW media, the drive will perform a blank check no matter what this bit is set to.

### SX - Y

This notation represents DIP switch "S50X - Y." The bit reflects the condition of each switch. If the switch is on, the bit will return 1. And if the switch is off, the bit will return 0.



**START/STOP UNIT****1BH****FUNCTION**

Starts or stops the rotation of the medium and/or ejects the medium from the drive unit.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
<b>0</b>	Operation Code (1BH)											
<b>1</b>	Logical Unit Number			Reserved				Immed				
<b>2</b>	Reserved											
<b>3</b>	Reserved											
<b>4</b>	Reserved					LoEj	Start					
<b>5</b>	Reserved					Flag	Link					

**Immed**

Immediate bit of 1 indicates that the status is returned as soon as the Command Descriptor Block has been validated. Immediate bit of 0 indicates that the status is returned after the command completion.

**LoEj**

Load Eject bit of 0 requests that no action will be taken regarding loading or ejecting the medium. Load Eject bit of 1 requests to unload the medium if Start bit is 0. Load Eject bit of 1 requests to load the medium if Start bit is 1.

**Start**

Start bit of 1 requests that the drive to be ready for use (start the rotation of the medium).

Start bit of 0 requests to stop the drive (stop the rotation of the medium).

**RECEIVE DIAGNOSTIC RESULTS****1CH****FUNCTION**

Requests to send the diagnostic test data which is the result of Send Diagnostic Command to the initiator.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
<b>0</b>	Operation Code (1CH)												
<b>1</b>	Logical Unit Number			Reserved									
<b>2</b>	Reserved												
<b>3</b>	Allocation Length (MSByte)												
<b>4</b>	Allocation Length (LSByte)												
<b>5</b>	Reserved					Flag	Link						

**Allocation Length**

Allocation Length field specifies the number of bytes allocated for returning data. Allocation Length of 0 indicates that no data is to be transferred. This condition is not considered as an error. The drive returns the number of either specified bytes or all available diagnostic data, whichever is less.

The form of Receive Diagnostic Results Page Codes is shown in the following table:

Page Code	Maximum Transfer Length	Description
00H	6	Supported Diagnostics Pages
81H	10	Controller Test

## RECEIVE DIAGNOSTIC RESULTS (1CH)

The form of Supported Diagnostic Pages is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Page Code (00H)
1								Reserved
2								Page Length (0) (MSByte)
3								Page Length (2) (LSByte)
4								Supported Page List (00H)
5								Supported Page List (81H)

The form of Controller Test is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Page Code (81H)
1								Reserved
2								Page Length (0) (MSByte)
3								Page Length (6) (LSByte)
4							Reserved	Success
5								Loop Count Completed
6								Internal Error Code (MSByte)
7								Internal Error Code
8								Internal Error Code
9								Internal Error Code (LSByte)

### Success

This bit being 1 indicates that the Controller Test has passed without any internal error.

Otherwise, this bit being 0 indicates that there is internal error(s).

Internal Error Code is explained in Appendix A.

**SEND DIAGNOSTIC****1DH****FUNCTION**

Requests the drive to perform diagnostic tests. This command should be followed by RECEIVE DIAGNOSTIC RESULTS command except when the Self Test bit is 1.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (1DH)							
1	Logical Unit Number		PF (1)	Reserved	SelfTest	DevOfL	UnitOfL	
2	Reserved							
3	Parameter List Length (MSByte)							
4	Parameter List Length (LSByte)							
5	Reserved					Flag	Link	

**PF**

Page Format bit of 1 specifies that the SEND DIAGNOSTIC parameters confirm to the page structure as specified in this manual. Page Format bit of 0 indicates that the SEND DIAGNOSTIC parameters are all vendor-specific. This bit is fixed to 1.

**SelfTest**

Self Test bit of 1 requests the Self Test to run. This Self Test is similar to the execution of test sequence 1 or Power-On sequence. If this bit is 1, the Parameter List Length must be 0. Self Test bit of 0 indicates the test is requested in the Parameter List (see Send Diagnostic Command Page Codes).

**DeOfL**

Device Off-Line bit of 1 must be set for proper operation of any test besides Self Test.

**UnitOfL**

Unit Off-Line bit of 1 must be set for proper operation of any test besides Self Test.

**Parameter List Length**

Indicates the number of parameter bytes in Data Out phase which defines the selected test. This value must be 0 if the SelfTest bit is set to 1.

## SEND DIAGNOSTIC (1DH)

The form of the Send Diagnostic Command Page Codes is shown in the following table:

Page Code	Maximum Transfer Length	Description
00H	4	Supported Diagnostics Pages
81H	12	Controller Test

The form of Supported Diagnostic Pages is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Page Code (00H)							
1	Reserved							
2	Page Length (0) (MSByte)							
3	Page Length (0) (LSByte)							

The form of the Controller Test is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0							
0	Page Code (81H)														
1	Reserved														
2	Page Length (0) (MSByte)														
3	Page Length (8) (LSByte)														
4	No Break	Test Number (see Diagnostic Table)													
5	Loop Count														
6	Reserved														
7	Reserved														
8	Reserved														
9	Reserved														
10	Reserved														
11	Reserved														

### No Break

No Break bit of 1 directs the drive not to terminate looping when an error is detected.

**Loop Count**

This field contains the number of repetition of diagnostics to be performed. When this field is 00H, it means 256 repetitions.

The following table shows the Diagnostic Test Name and its Test Number:

**Diagnostic Table:**

Diagnostic Test Name	Test Number (Hex)
Self Test	0X01
ROM Checksum Test	0X02
Microprocessor Test	0X03
Buffer RAM Test	0X04
ODC Chip Test	0X05
DSP Communication Test	0X06

# **PREVENT/ALLOW MEDIUM REMOVAL**

**1EH**

## **FUNCTION**

Prevents or allows the removal of the medium from the logical unit.

## **CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
<b>0</b>	Operation Code (1EH)												
<b>1</b>	Logical Unit Number			Reserved									
<b>2</b>	Reserved												
<b>3</b>	Reserved												
<b>4</b>	Reserved						<b>PMI</b>						
<b>5</b>	Reserved					<b>Flag</b>	<b>Link</b>						

## **Prevent**

Prevent bit of 1 inhibits the removal of the medium. When this bit is set to 1, the ejection button of the drive is disabled and a START/STOP UNIT command with its eject bit set to 1 returns the CHECK CONDITION status. Prevent bit of 0 allows the removal of medium.

The prevention of medium removal is terminated upon receiving PREVENT/ALLOW MEDIUM REMOVAL command with prevent bit set to 0; BUS DEVICE RESET message from any initiator; or RESET condition.

**READ CAPACITY****25H****FUNCTION**

Determines the capacity of the optical disk which is currently in the drive. The Logical Block Address and Block Length of the last logical block on the medium are returned.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Page Code (25H)
1		Logical Unit Number				Reserved		RelAdr
2				Logical Block Address (MSByte)				
3					Logical Block Address			
4						Logical Block Address		
5							Logical Block Address (LSByte)	
6							Reserved	
7							Reserved	
8								PMI
9							Flag	Link

**PMI**

Partial Medium Indicator bit of 1 indicates that the Logical Block Address field does not need to be set to 0. Partial Medium Indicator bit of 0 indicates that the Logical Block Address field must be 0. This bit does not affect the returning values for this drive and the Logical Block Address is always set to 0. (This bit makes a difference when the medium is a partial ROM which is not commercially available at this point.)

The form of Read Capacity Command Returned Data is shown in the following form:

Byte	Description
0	Logical Block Address (MSB)
1	Logical Block Address
2	Logical Block Address
3	Logical Block Address (LSB)
4	Block Length (MSB)
5	Block Length
6	Block Length
7	<b>Block Length (LSB)</b>

**READ(10)****28H****FUNCTION**

Reads the specified number of data starting from the specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		
0	Page Code (28H)									
1	Logical Unit Number			DPO	FUA	Reserved	RelAdr			
2	Logical Block Address (MSByte)									
3	Logical Block Address									
4	Logical Block Address									
5	Logical Block Address (LSByte)									
6	Reserved									
7	Transfer Length (MSByte)									
8	Transfer Length (LSByte)									
9	PBA	Reserved				Flag	Link			

**DPO**

Disable Page Out bit of 1 instructs the drive not to store Read-Ahead Data in the cache. Disable Page Out bit of 0 indicates that the drive may store the Read-Ahead Data after transferring the specified data to the initiator. However, the drive ignores this bit.

**FUA**

Force Unit Access bit of 1 indicates that the drive reads data from the disk. Force Unit Access bit of 0 indicates that the data may come from the cache memory.

**Transfer Length**

This field indicates the number of contiguous logical blocks to be transferred for this command. A field value of 0 indicates that no blocks will be transferred and this is not considered as an error.

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. Physical Block Address bit of 0 indicates that logical block addressing is used.

**Note:**

If a blank block is detected during blank checking, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/93H/00H (BLANK CHECK/Blank Sector Detected).

**WRITE(10)****2AH****FUNCTION**

Write data to the specified logical block address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		
<b>0</b>	Page Code (2AH)									
<b>1</b>	Logical Unit Number		DPO	FUA	EBP	Reserved	RelAdr			
<b>2</b>	Logical Block Address (MSByte)									
<b>3</b>	Logical Block Address									
<b>4</b>	Logical Block Address									
<b>5</b>	Logical Block Address (LSByte)									
<b>6</b>	Reserved									
<b>7</b>	Transfer Length (MSByte)									
<b>8</b>	Transfer Length (LSByte)									
<b>9</b>	PBA	ErsCntl	Reserved			Flag	Link			

**DPO**

Disable Page Out bit of 1 instructs the drive not to store the data in the cache. Disable Page Out bit of 0 instructs the drive to store the data in the cache after it has been transferred to the medium. However, this bit is ignored.

**FUA**

Force Unit Access bit of 1 indicates that the data is written directly to the disk. Force Unit Access bit of 0 indicates the write caching will be allowed.

**EBP**

If the Erase Bypass bit is set to 0, ERASE operation is automatically performed before writing the data. Erase Bypass bit of 1 suppresses the ERASE operation.

### **Transfer Length**

This field indicates the number of contiguous logical blocks to be transferred for this command. A field value of 0 indicates that no blocks will be transferred and this is not considered as an error.

### **PBA**

Physical Block Address bit of 1 indicates that the physical block addressing is used. Physical Block Address bit of 0 indicates that the logical block addressing is used.

### **ErsCtl**

Erase Control bit is identical to Erase Bypass bit.

### Write-Once Medium

If a written block is detected during the operation of this command, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/92H/00H (BLANK CHECK/ Overwrite Attempted).

### **Note:**

When this command is issued while 600 Mbyte/650 Mbyte media and 1.2 Gbyte/1.3 Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

**SEEK(10)****2BH****FUNCTION**

Moves the optical head to the physical track where the specified logical block exists. This function is exactly the same as that of the SEEK (6) command.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
<b>0</b>	Operation Code (2BH)											
<b>1</b>	Logical Unit Number				Reserved							
<b>2</b>	Logical Block Address (MSByte)											
<b>3</b>	Logical Block Address											
<b>4</b>	Logical Block Address											
<b>5</b>	Logical Block Address (LSByte)											
<b>6</b>	Reserved											
<b>7</b>	Reserved											
<b>8</b>	Reserved											
<b>9</b>	PBA	Reserved				Flag	Link					

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. Physical Block Address bit of 0 indicates that logical block addressing is used.

**ERASE(10)****2CH****FUNCTION**

Erases the specified number of data blocks starting from the specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
0	Operation Code (2CH)											
1	Logical Unit Number		Reserved		ERA	Reserved	RelAdr					
2	Logical Block Address (MSByte)											
3	Logical Block Address											
4	Logical Block Address											
5	Logical Block Address (LSByte)											
6	Reserved											
7	Transfer Length (MSByte)											
8	Transfer Length (LSByte)											
9	PBA	Reserved				Flag	Link					

**ERA**

Erase All bit of 1 indicates that all remaining blocks, starting from the specified Logical Block Address to the end of the disk, are erased. Transfer Length must be set to 0. Erase All bit of 0 indicates that all blocks, starting from the specified Logical Block Address for the specified Transfer Length, are erased.

**Transfer Length**

This field indicates the number of contiguous logical blocks to be erased by this command. A field value of 0 indicates that no blocks will be erased and this is not considered as an error.

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. Physical Block Address bit 0 indicates that logical block addressing is used.

Write-Once Medium

If this command is executed for Write-Once medium, the drive returns a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 05H/20H/00H (ILLEGAL REQUEST/Invalid Command Operation Code).

**Note:**

When this command is issued while 600 Mbyte/650 Mbyte media and 1.2 Gbyte/1.3 Gbyte are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

**WRITE AND VERIFY(10)****2EH****FUNCTION**

Writes data to the medium and then verifies the written data by checking the Error Correction Code.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (2EH)							
1	Logical Unit Number		DPO	Reserved	EBP	Reserved	RelAdr	
2	Logical Block Address (MSByte)							
3	Logical Block Address							
4	Logical Block Address							
5	Logical Block Address (LSByte)							
6	Reserved							
7	Transfer Length (MSByte)							
8	Transfer Length (LSByte)							
9	PBA	ErsCntl	Reserved			Flag	Link	

**DPO**

Disable Page Out bit of 1 instructs the drive not to store the data in the cache after it has been transferred to the medium. Disable Page Out bit of 0 instructs the drive to store the data in the cache after it has been transferred to the medium. However, this bit is ignored.

**EBP**

If the Erase Bypass bit is set to 0, ERASE operation is automatically performed before writing the data. Erase Bypass bit of 1 suppresses the ERASE operation.

**Transfer Length**

This field indicates the number of contiguous logical blocks to be transferred for this command. A field value of 0 indicates that no blocks will be transferred and this is not considered as an error.

**PBA**

Physical Block Address bit of 1 indicates that the physical block addressing is used. Physical Block Address bit of 0 indicates that the logical block addressing is used.

**ErsCtl**

Erase Control bit is identical to Erase Bypass bit.

**Write-Once Medium**

If a written block is detected during the operation of this command, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/92H/00H (BLANK CHECK/ Overwrite Attempted).

**Note:**

When this command is issued while 600 Mbyte/650 Mbyte media and 1.2 Gbyte/1.3 Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

**VERIFY(10)****2FH****FUNCTION**

Verifies the specified length of data starting from the specified Logical Block Address by reading and checking the Error Correction Code.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (2FH)							
1	Logical Unit Number		DPO	Reserved	BlkVfy	Reserved	RelAdr	
2	Logical Block Address (MSByte)							
3	Logical Block Address							
4	Logical Block Address							
5	Logical Block Address (LSByte)							
6	Reserved							
7	Verification Length (MSByte)							
8	Verification Length (LSByte)							
9	Reserved				Flag	Link		

**DPO**

Disable Page Out bit of 1 instructs the drive not to retain the data in the cache after it has been verified. Disable Page Out bit of 0 instructs the drive to retain the data in the cache after it has been verified. However, this bit is ignored.

**BlkVfy**

Blank Verify bit of 1 indicates that the drive verifies whether the specified sectors are erased or not. Blank Verify bit of 0 indicates that the drive verifies the written data integrity.

**Verification Length**

This field indicates the number of contiguous logical blocks to be verified by this command. A field value of 0 indicates that no blocks will be verified and this is not considered as an error.

**Note:**

If a blank sector is detected during operation, the drive returns a CHECK CONDITION status and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier to 08H/93H/00H (BLANK CHECK/Blank Sector Detected).

**PRE-FETCH****34H****FUNCTION**

Transfers the specified number of data blocks starting from the specified Logical Blocks Address to the cache memory.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
<b>0</b>	Operation Code (34H)										
<b>1</b>	Logical Unit Number			Reserved			Immed	RelAdr			
<b>2</b>	Logical Block Address (MSByte)										
<b>3</b>	Logical Block Address										
<b>4</b>	Logical Block Address										
<b>5</b>	Logical Block Address (LSByte)										
<b>6</b>	Reserved										
<b>7</b>	Transfer Length (MSByte)										
<b>8</b>	Transfer Length (LSByte)										
<b>9</b>	Reserved					Flag	Link				

**Immed**

Immediate bit of 1 indicates that the drive returns a status as soon as the Command Descriptor Block is validated. Immediate bit of 0 indicates that the status is not returned until the operation is completed.

**Transfer Length**

This field indicates the number of contiguous logical blocks of data to be transferred.

**SYNCHRONIZE CACHE****35H****FUNCTION**

Ensures the logical blocks in the cache memory have their most recent data values recorded within the specified range of the optical disk. If more recent values exist in the cache memory, then the logical blocks on the optical disk will be replaced with the values in the cache memory.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
0	Operation Code (35H)										
1	Logical Unit Number			Reserved			Immed	RelAdr			
2	Logical Block Address (MSByte)										
3	Logical Block Address										
4	Logical Block Address										
5	Logical Block Address (LSByte)										
6	Reserved										
7	Number of Blocks (MSByte)										
8	Number of Blocks (LSByte)										
9	Reserved					Flag	Link				

**Immed**

Immediate bit of 1 indicates that the drive returns a status as soon as the Command Descriptor Block is validated. Immediate bit of 0 indicates that the status is not returned until the operation is completed.

**Number of Blocks**

Number of Blocks field specifies the total number of contiguous logical blocks on the disk of the range. Number of Blocks bit of 0 indicates that all the existing logical blocks on the disk is considered to be in the range. Logical block within the specified range of the disk and not in the cache memory is not considered as an error.

**READ DEFECT DATA(10)****37H****FUNCTION**

Reads the optical disk's defect information. The returning data contains a four byte header followed by zero or more Defect Descriptors.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0						
0	Operation Code (37H)													
1	Logical Unit Number		Reserved											
2	Reserved		PList	GList	Defect List Format									
3	Reserved													
4	Reserved													
5	Reserved													
6	Reserved													
7	Allocation Length (MSByte)													
8	Allocation Length (LSByte)													
9	Reserved				Flag	Link								

**PList, GList**

Grown List bit of 1 (and regardless of Primary List bit) indicates that the drive will return the contents of Primary Defect List and Secondary Defect List. Primary List bit of 1 and Grown List of 0 indicates that the drive will return only the contents of Primary Defect List.

**Defect List Format**

This field specifies the Format of returning Defect List. Only the Physical Sector Format(5) is supported. If the Block Format(0) is specified, the defect list will be returned in Physical Sector Format and a CHECK CONDITION status will be returned at the completion of the command with Sense Key/Additional Sense Code/Additional Sense Code Qualifier set to 01H/19H/01H (RECOVERED ERROR/Defect List Not Available).

**Allocation Length**

This field specifies the number of bytes that the initiator has allocated for the returning data. Allocation Length of 0 indicates that no data will be returned. This condition is not considered as an error. The drive will terminate the data-in-phase when the Allocation Length has been transferred or when all the available defect data has been transferred to the initiator, whichever with less length.

The format of returning Read Defect Data List Header is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
0	Reserved										
1	Reserved			PList	GList	Defect List Format					
2	Defect List Length (MSByte)										
3	Defect List Length (LSByte)										

### **PList**

Primary List bit of 1 indicates that the Primary List of defects was returned.

### **GList**

Grown List bit of 1 indicates that the Grown List of defects was returned.

### **Defect List Format**

This field will be set as the same value indicated in Defect List Format field (which has the fixed value of 5) of CDB. And this specifies the format of the Defect List Data returned by the drive.

### **Defect List Length**

This field specifies the total length of the Defect Descriptor in bytes.

The format of Physical Sector Format Defect Descriptor is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Physical Track Number of the Defect (MSByte)							
1	Physical Track Number of the Defect							
2	Physical Track Number of the Defect (LSByte)							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Defective Physical Sector Number							

**MEDIUM SCAN****38H****FUNCTION**

Scans the medium for a contiguous set of written or blank logical blocks. In order to use this command with rewritable or CCW media, all the sectors has to be erased beforehand.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		
<b>0</b>	Operation Code (38H)									
<b>1</b>	Logical Unit Number		WBS	ASA (0)	RSD (0)	PRA (0)	RelAdr			
<b>2</b>	Logical Block Address (MSByte)									
<b>3</b>	Logical Block Address									
<b>4</b>	Logical Block Address									
<b>5</b>	Logical Block Address (LSByte)									
<b>6</b>	Reserved									
<b>7</b>	Reserved									
<b>8</b>	Parameter List Length									
<b>9</b>	VU (0)	Reserved			Flag	Link				

**WBS**

Written Block Search bit being 0 indicates the scan is for blank blocks.

Written Block Search bit being 1 indicates the scan is for written blocks.

**ASA**

Advanced Scan Algorithm bit being 0 indicates that the scan area is scanned in sequential order. This bit cannot be changed.

**RSD**

Reverse Scan Direction bit of 0 indicates that the scan will begin from the first logical block of the scan area. This bit cannot be changed.

**PRA**

Partial Results Accepted bit of 0 indicates that the scan will not be completed until a contiguous set of blocks is found, within the scan area which is greater than or equal to the number of blocks requested in size. And the other criteria specified in the Command Descriptor Block have to be met. This bit cannot be changed.

**RA**

Relative Address bit of 0 indicates that the LBA field is not a relative address but an absolute address. This means the relative addressing function of linked commands is not in effect. This bit cannot be changed.

**Parameter List Length**

This field specifies the length of the list which will be transferred during the data out phase in bytes. Parameter List Length bit being 0 indicates that the Number of Blocks Requested and Number of Blocks to Scan have the values of 1 and 0, respectively.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Number of Blocks Requested (MSByte)
1								Number of Blocks Requested
2								Number of Blocks Requested
3								Number of Blocks Requested (LSByte)
4								Number of Blocks to Scan (MSByte)
5								Number of Blocks to Scan
6								Number of Blocks to Scan
7								Number of Blocks to Scan (LSByte)

**Number of Blocks Requested**

This field specifies the number of continuous blocks that must meet the specified requirements (all written or all blank). If set to zero, the scan will not take place and this is not considered an error condition. The maximum value for the Number of Blocks Requested is 65535 (FFFF H).

In order to ensure reliability for all media conditions and environments, the scan for minimum of two contiguous blanks when the WBS bit is set to zero, and the Number of Blocks Requested field is set to one.

**Number of Blocks to Scan**

This field specifies the length of the area to be scanned in blocks. If set to zero, the scan will continue for all the remaining blocks on the medium or until the scan is satisfied.

**WRITE BUFFER****3BH****FUNCTION**

Writes data to the data buffer.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
0	Operation Code (3BH)												
1	Logical Unit Number			Reserved		Mode							
2	Buffer ID												
3	Buffer Offset (MSByte)												
4	Buffer Offset												
5	Buffer Offset (LSByte)												
6	Parameter List Length (MSByte)												
7	Parameter List Length												
8	Parameter List Length (LSByte)												
9	Reserved					Flag	Link						

**Mode**

This field indicates which data format is used. Refer to the table of Buffer Access Mode and ID.

**Buffer ID**

This field indicates which buffer is used. Refer to the table of Buffer Access Mode and ID.

**Buffer Offset**

This field indicates the address of the buffer data with the offset from the beginning of the buffer.

**Parameter List Length**

This field indicates the length of data bytes to be written in the buffer.

### Buffer Access Mode and ID

Buffer Type	Buffer ID	Mode
Buffer RAM	0	0

#### Buffer RAM

This mode indicates that the data buffer space is used for data transfer to/from the optical disk.

Mode field specifies the function of this command and meaning of fields within the Command Descriptor Block. Mode field is defined in following table.

Mode	Description
000b	writes Combined Header and Data (Buffer Offset = 0)
001b	writes Combined Header and Data
010b	writes Data

#### Combined Header and Data Mode (000b, 001b)

With this mode, the transfer data consists of a four-byte header and the write buffer data. Transfer data length is specified by the Parameter List Length field. Parameter List Length of zero indicates that no write buffer header and no write data is transferred. This condition is not considered as an error. The maximum number of bytes that shall be transferred during the DATA OUT phase is indicated by the Buffer Capacity of the four-byte header, that is determined by the READ BUFFER command. If Mode is 0, the write buffer data is stored in the buffer memory starting from address 0. In this case, the Buffer Offset field must be set to 0. If the Mode is 1, the Buffer Offset field indicates the starting address of the buffer memory where the WRITE BUFFER data is written.

The four-byte header consists of all reserved bytes showed in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved							
1	Reserved							
2	Reserved							
3	Reserved							

**Data Mode (010b)**

With this mode, transfer data contains buffer data during the DATA OUT phase. Buffer Offset field specifies the location where the data is written. Parameter List Length field specifies the number of bytes that shall be transferred and stored in the buffer memory during the DATA OUT phase. Buffer offset plus Parameter List Length shall not exceed the capacity of the buffer memory.

**READ BUFFER****3CH****FUNCTION**

Reads data from the data buffer of the drive.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0					
0	Operation Code (3CH)												
1	Logical Unit Number			Reserved		Mode							
2	Buffer ID												
3	Buffer Offset (MSByte)												
4	Buffer Offset												
5	Buffer Offset (LSByte)												
6	Parameter List Length (MSByte)												
7	Parameter List Length												
8	Parameter List Length (LSByte)												
9	Reserved					Flag	Link						

**Mode**

This field indicates which data format is used. Refer to the table of Buffer Access Mode and ID.

**Buffer ID**

This field indicates which buffer is used. Refer to the table of Buffer Access Mode and ID.

**Buffer Offset**

This field indicates the address the data should be read from with the offset from the beginning of the buffer.

**Parameter List Length**

This field indicates the length of data bytes to be read from the buffer.

### Buffer Access Mode and ID

Buffer Type	Buffer ID	Mode
Buffer RAM	0	0

Mode field specifies the function of this command and meaning of fields within the Command Descriptor Block. Mode field is defined in following table:

Mode	Description
000b	transfers Combined Header and Data (Buffer Offset = 0)
001b	transfers Combined Header and Data
010b	transfers Data
011b	transfers Descriptor

### Combined Header and Data Mode (000b, 001b)

With this mode, a four-byte header followed by data bytes is returned to the initiator during the DATA IN phase. The four-byte header has the following format:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved							
1	Buffer Capacity (MSByte)							
2	Buffer Capacity							
3	Buffer Capacity (LSByte)							

If the mode is zero, the buffer offset field must be set to 0. Parameter List Length specifies the number of bytes that the initiator has allocated for the returning data. The drive transfers the Parameter List Length bytes or the four-byte header and the buffer data, whichever is less.

### Buffer Capacity

This field returns the size of the buffer memory.

### Data Mode (010b)

With this mode, the transfer data contains buffer data during the DATA IN phase. Buffer Offset field contains the offset bytes where data shall be transferred from within the data buffer of the drive. Parameter List Length specifies the number of bytes that the initiator has allocated for the returning data. The drive transfers the Parameter List Length bytes or all the available data from the buffer, whichever is less.

### **Descriptor Mode (011b)**

With this mode, READ BUFFER descriptor information with the maximum size of four-bytes is returned. Buffer Offset field is reserved in this mode. READ BUFFER descriptor is as follows:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0					Offset Boundary			
1					Buffer Capacity (MSByte)			
2					Buffer Capacity			
3					Buffer Capacity (LSByte)			

#### **Offset Boundary**

This field returns the boundary address of subsequent WRITE BUFFER and READ BUFFER commands in the buffer memory. The value of Offset Boundary field is expressed in powers of two (i. e. =  $2^n$ ). As the drive has byte boundaries, it returns zero for Offset Boundary field.

**READ LONG****3EH****FUNCTION**

Read data from the specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
0	Operation Code (3EH)											
1	Logical Unit Number			Reserved				RelAdr				
2	Starting Logical Block Address (MSByte)											
3	Starting Logical Block Address											
4	Starting Logical Block Address											
5	Starting Logical Block Address (LSByte)											
6	Reserved											
7	Transfer Length (MSByte)											
8	Transfer Length (LSByte)											
9	PBA	SC	Reserved				Flag	Link				

**Transfer Length**

This field specifies the number of data bytes and Error Correction Code information to be read.

- \* 2048 media = 2380 bytes (2048 data + 332 pointers, CRC, pad and ECC)
- \* 1024 media = 1200 bytes (1024 data + 176 pointers, CRC, pad and ECC)
- \* 512 media = 630 bytes (512 data + 118 pointers, CRC, pad and ECC)  
(4.1Gbyte media)
- \* 512 media = 610 bytes (512 data + 98 pointers, CRC, pad and ECC)  
(600 Mbyte, 1.2Gbyte and 2.3Gbyte media)
- \* all other numbers are rejected unless SC = 1

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. Physical Block Address bit of 0 indicates that logical block addressing is used.

**SC**

Sector Count bit of 1 indicates that the Transfer Length is represented in sectors rather than bytes. Sector Count bit of 0 indicates that the Transfer Length is represented in bytes.

Write-Once Medium

If a blank block is detected during blank checking, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/93H/00H (BLANK CHECK/Blank Sector Detected).

**WRITE LONG****3FH****FUNCTION**

Writes data to the specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
0	Operation Code (3FH)											
1	Logical Unit Number			Reserved				RelAdr				
2	Starting Logical Block Address (MSByte)											
3	Starting Logical Block Address											
4	Starting Logical Block Address											
5	Starting Logical Block Address (LSByte)											
6	Reserved											
7	Transfer Length (MSByte)											
8	Transfer Length (LSByte)											
9	PBA	SC	Reserved				Flag	Link				

**Transfer Length**

This field specifies the number of data bytes and Error Correction Code information to be read.

- \* 2048 media = 2380 bytes (2048 data + 332 pointers, CRC, pad and ECC)
- \* 1024 media = 1200 bytes (1024 data + 176 pointers, CRC, pad and ECC)
- \* 512 media = 630 bytes (512 data + 118 pointers, CRC, pad and ECC)  
(4.1Gbyte media)
- \* 512 media = 610 bytes (512 data + 98 pointers, CRC, pad and ECC)  
(600 Mbyte, 1.2Gbyte and 2.3Gbyte media)
- \* all other numbers are rejected unless SC = 1

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. Physical Block Address bit of 0 indicates that logical block addressing is used.

**SC**

Sector Count bit of 1 indicates that the Transfer Length is represented in sectors rather than bytes. Sector Count bit of 0 indicates that the Transfer Length is represented in bytes.

Write-Once Medium

If a written block is detected during the operation of this command, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/92H/00H (BLANK CHECK/ Overwrite Attempted).

**Note:**

When this command is issued while 600 Mbyte/650 Mbyte media and 1.2 Gbyte/1.3Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

**CHANGE DEFINITION****40H****FUNCTION**

Modifies the operating definition of the drive.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0									
0	Operation Code (40H)																
1	Logical Unit Number			Reserved													
2	Reserved						Save										
3	Reserved	Definition Parameter															
4	Reserved																
5	Reserved																
6	Reserved																
7	Reserved																
8	Parameter Data Length																
9	Reserved				Flag		Link										

**Save**

This Save Control bit is not supported by this drive. Save Control bit of 1 indicates that the drive will return a CHECK CONDITION status. Additional Sense Key/Additional Sense Code Additional Sense Code Qualifier is set to 05H/24H/00H (ILLEGAL REQUEST/Illegal Field in CDB).

**Definition Parameter**

This field is defined in following table:

Value	Meaning of Definition Parameter
00H	Use Current Operating Definition
01H	SCSI-1
02H	CCS
03H	SCSI-2
40H	Sony SCSI-1

If SCSI-1 and CCS Definition Parameters are set to the Definition Parameter field, the drive internally modifies these parameters to the Sony SCSI-1 operating definition.

#### **Parameter Data Length**

Parameter Data Length field should be set to 0. Otherwise the drive returns a CHECK CONDITION status.

**LOG SELECT****4CH****FUNCTION**

Clears drive logs.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0											
0	Operation Code (4CH)																		
1	Logical Unit Number			Reserved															
2	PC (01H)		Reserved																
3	Reserved																		
4	Reserved																		
5	Reserved																		
6	Reserved																		
7	Parameter List Length (MSByte)																		
8	Parameter List Length (LSByte) (See the table)																		
9	Reserved					Flag	Link												

**PC**

Page Control field defines the type of parameter values to be returned as follows:

Bit 7	Bit 6	type of parameter values
0	1	Changeable Values

This field value is fixed.

**Parameter List Length**

The Parameter List Length field specifies the length of the Parameter List which will be transferred from the initiator to the drive in bytes during the DATA OUT phase. A Parameter List Length of 0 indicates that no pages will be transferred and this condition is not considered as an error.

The ONLY capability that the initiator is given from the Log Select is to reset the cumulative logs. The following table shows the format of Parameter List Data for Byte 8 of the Log Select command:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0					Page Code (see the table)			
1					Reserved			
2					Reserved			
3					Page Length			
4					Parameter Code (MSByte)			
5					Parameter Code (LSByte)			
6					Reserved			
7					Reserved			
8					Reserved			
9					Reserved			
10					Reserved			
11					Reserved			

### Page Code

Page Code values are defined in the following table:

Page Code	Description	Parameter Code
02H	Write Error Counter Page	8000
03H	Read Error Counter Page	8000
05H	Verify Error Counter Page	8000
07H	Last n Error Counter Page	1000
33H	Erase Error Counter Page	8000
34H	Blank Error Counter Page	8000

# LOG SENSE

# 4DH

## FUNCTION

Manages the statistical information maintained by the drive.

## CDB

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Operation Code (4DH)
1								Reserved
2	PC (01H)							Page Code
3								Reserved
4								Reserved
5								Parameter Pointer (MSByte)
6								Parameter Pointer (LSByte)
7								Allocation Length (MSByte)
8								Allocation Length (LSByte)
9							Reserved	Flag Link

## PC

Page Control field defines the type of parameter values to be returned as follows:

Bit 7	Bit 6	type of parameter values
0	1	Changeable Values

This field value is fixed.

## Parameter Pointer

When the initiator requests to recall parameter data, the drive returns the data starting from the Parameter Code indicated by the Parameter Pointer for the length of either the maximum Allocation Length or the maximum Parameter Code, whichever is less. Log parameters within the specified Log Page are transferred in ascending order according to Parameter Code.

## Allocation Length

The number of parameter bytes allocated for the Log Page and the Parameter Codes/Structure.

## Page Codes

Page Codes are defined in the following table:

Page Code	Description
00H	Supported Log Pages
02H	Error Counter Page for Write Errors
03H	Error Counter Page for Read Errors
05H	Error Counter Page for Verify Errors
07H	Last n Error Events Page
33H	Error Counter Page for Erase Errors
34H	Error Counter Page for Blank Check Errors

### Supported Log Page 00H

The Supported Log Page returns the list of log pages implemented by the drive (Supported Page List).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved							Page Code (00H)
1								Reserved
2								Page Length (n-3) (MSByte)
3								Page Length (n-3) (LSByte)
4								Supported Page List
								Supported Page List
n								Supported Page List

### Page Length

Page Length field indicates the length of the following log parameters in bytes.

**Log Page Format**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0						
0	Reserved		Page Code											
1	Reserved													
2	Page Length (n-3) (MSByte)													
3	Page Length (n-3) (LSByte)													
<b>Log Parameter(s)</b>														
4	Log Parameter (First)													
X + 3	(Length x)													
N - y	Log Parameter (Last)													
n	(Length y)													

**Log Parameter**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Parameter Code (MSByte)							
1	Parameter Code (LSByte)							
2	Reserved							
3	Parameter Length (n-3)							
<b>Parameter Value</b>								
4	Parameter Value (MSByte)							
n	Parameter Value (LSByte)							

**Parameter Codes/Structure for Error Counter Pages**

<b>Parameter Code</b>	<b>Length Bytes</b>	<b>Description</b>
1	12	Sectors Corrected with Retries
2	12	Total Number of Retry Attempts
3	12	Total Sectors Corrected
5	14	Total Bytes Processed
6	12	Total Number of Uncorrectable Sectors
0	46	Request for all Pages

**Parameter Codes/Structure for Last n Error Event Page**

<b>Parameter Code</b>	<b>Length Bytes</b>	<b>Description</b>
0	10	Number of Events in the Log (Maximum Events = 50)
1	34	Most Recent Error Event Log
2		Next Most Recent Error Event Log
•	•	•
•	•	•
•	•	•
n	1510	Request for all Pages

**Error Event Log**

<b>Byte</b>	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>
<b>0</b>								Log Type (1 - READ, 2 - WRITE, 3 - ERASE, 4 - VERIFY, 5 - BLANK CHECK)
<b>1</b>								Occurrence Count
<b>2</b>	Long (1)							Power On Minutes
<b>3</b>								Half Seconds
<b>4</b>								Half Seconds Fraction (16 µSec) (MSByte)
<b>5</b>								Half Seconds Fraction (16 µSec) (LSByte)
<b>6</b>								Power On Hours (MSByte)
<b>7</b>								Power On Hours
<b>8</b>								Power On Hours
<b>9</b>								Power On Hours (LSByte)
<b>10</b>								Reserved
<b>11</b>								Reserved
<b>12</b>								Reserved
<b>13</b>								Reserved
<b>14</b>								Internal Error Code (MSByte)
<b>15</b>								Internal Error Code
<b>16</b>								Internal Error Code
<b>17</b>								Internal Error Code (LSByte)
<b>18</b>								Logical Block Address (MSByte)
<b>19</b>								Logical Block Address
<b>20</b>								Logical Block Address
<b>21</b>								Logical Block Address (LSByte)
<b>22</b>								Physical Block Address (MSByte)
<b>23</b>								Physical Block Address
<b>24</b>								Physical Block Address
<b>25</b>								Physical Block Address (LSByte)

**MODE SELECT(10)****55H****FUNCTION**

MODE SELECT command sets the optical disk and drive parameters for READ, WRITE, FORMAT and ERASE commands.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
<b>0</b>	Operation Code (55H)										
<b>1</b>	Logical Unit Number			PF	Reserved			SP			
<b>2</b>	Reserved										
<b>3</b>	Reserved										
<b>4</b>	Reserved										
<b>5</b>	Reserved										
<b>6</b>	Reserved										
<b>7</b>	Parameter List Length (MSByte)										
<b>8</b>	Parameter List Length (LSByte)										
<b>9</b>	Reserved					Flag	Link				

**PF**

Page Format bit of 0 indicates that all the parameters after the Block Descriptors are vendor-specific. This bit of 1 indicates that the parameters following the Header and Block Descriptor(s) are structured as the specified in the following pages.

Page Format bit is not supported by the drive and has no effect on the drive.

**SP**

Save Pages bit of 1 indicates that the drive performs the specified MODE SELECT operation, and saves all the savable data to non-volatile storage. The data is saved only if it is different from those currently saved. Save Page bit of 0 indicates that the drive performs the specified MODE SELECT operation and does not save any pages.

### Parameter List Length

This field specifies the length of the MODE SELECT Parameter List in bytes that the initiator will transfer to the drive during the DATA OUT phase. Parameter List Length of 0 indicates that no data will be transferred. This condition is not considered as an error.

In this command, the Mode Select Parameter Header is extended to 8 byte. The MODE SELECT parameter list format is as follows:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
<b>Mode Select Parameter Header</b>								
0								Reserved
1								Reserved
2								Medium Type
3								Reserved
4								Reserved
5								Reserved
6								Block Descriptor Length (MSByte)
7								Block Descriptor Length (LSByte)
<b>Block Descriptor(s)</b>								
8 - m								Block Descriptor
<b>Page(s)</b>								
m - n								Page

### Medium Type

Medium Type field shall be set to 00H (only one medium type is supported), 02H (WO media) or 03H (Rewritable medium).

### Block Descriptor Length

Block Descriptor Length specifies the length of Block Descriptors in bytes. It shall be equal to the number of Block Descriptors times 8. Block Descriptor Length of 0 indicates that no Block Descriptor is included in the parameter list. This condition is not considered as an error. Block Descriptor has no effect on the drive.

The form of Block Descriptor is shown in the following table:

<b>Byte</b>	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>
<b>0</b>	Density Code							
<b>1</b>	Number of Blocks (MSByte)							
<b>2</b>	Number of Blocks							
<b>3</b>	Number of Blocks (LSByte)							
<b>4</b>	Reserved							
<b>5</b>	Block Length (MSByte)							
<b>6</b>	Block Length							
<b>7</b>	Block Length(LSByte)							

Refer to the MODE SELECT (Group 0) command for detailed information about each page.

**MODE SENSE(10)****5AH****FUNCTION**

Acquires the parameters of medium, drive and drive controller.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Operation Code (5AH)
1			Logical Unit Number	Rsvd	DBD			Reserved
2		PC						Page Code
3								Reserved
4								Reserved
5								Reserved
6								Reserved
7								Allocation Length (MSByte)
8								Allocation Length (LSByte)
9							Flag	Link

**DBD**

Disable Block Descriptors bit of 1 indicates that the Block Descriptor is not provided. On the other hand, this bit being 0 indicates that the Block Descriptor is provided.

**PC**

Page Control field defines the type of parameter values to be returned as follows:

bit 7	bit 6	Type of parameter Values
0	0	Current Values
0	1	Changeable Values
1	0	Default Values
1	1	Saved Values

**Page Code**

Page Code values are the same as for the Mode Select (Group 0) command. If 00H or 3FH is specified, all the pages are returned.

### Allocation Length

This field specifies the number of bytes that the initiator has allocated for the return of this data. Allocation Length bit of 0 indicates that there will be no returned data. This condition is not considered as an error. The drive will terminate the data-in-phase either when the Allocation Length has been transferred or when all the available data has been transferred to the initiator, whichever with less length.

MODE SENSE Parameter Header is defined in following table.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Mode Data Length (MSByte)
1								Mode Data Length (LSByte)
2								Medium Type
3	WP	Reserved		DPOFUA				Reserved
4								Reserved
5								Reserved
6				Block Descriptor Length (MSByte)				
7				Block Descriptor Length (LSByte)				

### Mode Data Length

This field specifies the length of MODE SENSE data to follow in bytes.

### Medium Type

Medium Type field is set to 00H (default: only one medium type to be supported), 02H (Write-Once medium), or 03H (rewritable medium) depending on the drive condition. It will be set to 00H for no disk or not ready condition and 02H or 03H if it is ready to access the medium.

### WP

Write Protect bit of 1 indicates that the optical disk in the drive is write protected.

### DPOFUA

This bit indicates DPO/FUA (DPO: Disable Page Out, FUA: Force Unit Access) is supported or not. This bit being 1 indicates DPO/FUA flag is supported. This bit being 0 indicates DPO/FUA is not supported. This bit is fixed to be 1.

**Block Descriptor Length**

Block Descriptor Length field specifies the length of the Block Descriptor in bytes. This field is set to 8 when DBD bit is 0. Otherwise, this field is set to 0.

The format of Block Descriptor is show in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Density Code							
1	Number of Blocks (MSByte)							
2	Number of Blocks							
3	Number of Blocks (LSByte)							
4	Reserved							
5	Block Length (MSByte)							
6	Block Length							
7	Block Length (LSByte)							

Refer to the MODE SELECT (Group 0) command for detailed information about each page.

**READ(12)****A8H****FUNCTION**

Reads data from the specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
<b>0</b>	Operation Code (A8H)											
<b>1</b>	Logical Unit Number		DPO	FUA	Reserved		RelAdr					
<b>2</b>	Logical Block Address (MSByte)											
<b>3</b>	Logical Block Address											
<b>4</b>	Logical Block Address											
<b>5</b>	Logical Block Address (LSByte)											
<b>6</b>	Transfer Length (MSByte)											
<b>7</b>	Transfer Length											
<b>8</b>	Transfer Length											
<b>9</b>	Transfer Length (LSByte)											
<b>10</b>	Reserved											
<b>11</b>	PBA	Reserved				Flag	Link					

**DPO**

Disable Page Out bit of 1 instructs the drive not to store Read-Ahead Data in the cache. Disable Page Out bit of 0 indicates that the drive may store the Read-Ahead Data after transferring the specified data to the initiator. However, this bit is ignored.

**FUA**

Force Unit Access bit of 1 indicates that the drive reads data from the disk. Force Unit Access bit of 0 indicates that the data may come from the cache memory.

**Transfer Length**

This field indicates the number of contiguous logical blocks to be transferred for this command. A field value of 0 indicates that no blocks will be transferred and this is not considered as an error.

**PBA**

Physical Block Address bit of 1 indicates that physical block addressing is used. A field value of 0 indicates that logical block addressing is used.

**Note:**

If a blank block is detected during the operation of this command, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/93H/00H (BLANK CHECK/Blank Sector Detected).

**WRITE(12)****AAH****FUNCTION**

Writes the specified number of data to the specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		
<b>0</b>	Operation Code (AAH)									
<b>1</b>	Logical Unit Number		DPO	FUA	EBP	Reserved	RelAdr			
<b>2</b>	Logical Block Address (MSByte)									
<b>3</b>	Logical Block Address									
<b>4</b>	Logical Block Address									
<b>5</b>	Logical Block Address (LSByte)									
<b>6</b>	Transfer Length (MSByte)									
<b>7</b>	Transfer Length									
<b>8</b>	Transfer Length									
<b>9</b>	Transfer Length (LSByte)									
<b>10</b>	Reserved									
<b>11</b>	PBA	ErsCntl		Reserved			Flag	Link		

**DPO**

Disable Page Out bit of 1 instructs the drive not to store the data in the cache. Disable Page Out bit of 0 instructs the drive to store the data in the cache after it has been transferred to the medium. However, this bit is ignored.

**FUA**

Force Unit Access bit of 1 indicates that the date is written directly to the disk. Force Unit Access bit of 0 indicates the write caching will be allowed.

**EBP**

If the Erase Bypass bit is set to 0, the ERASE operation is automatically performed before writing the data. Erase Bypass bit of 1 suppresses the ERASE operation.

### **Transfer Length**

This field indicates the number of contiguous logical blocks to be transferred for this command. A field value of 0 indicates that no blocks will be transferred and this is not considered as an error.

### **PBA**

Physical Block Address bit of 1 indicates that the physical block addressing is used. Physical Block Address bit of 0 indicates that the logical block addressing is used.

### **ErsCntl**

Erase Control bit is identical to Erase Bypass bit.

### Write-Once Medium

If a written block is detected during blank checking, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/92H/00H (BLANK CHECK/ Overwrite Attempted).

### **Note:**

When this command is issued while 600 Mbyte/650 Mbyte media and 1.2 Gbyte/1.3 Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

**ERASE(12)****ACH****FUNCTION**

Erases the specified number of data blocks starting from the specified Logical Block Address.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
0	Operation Code (ACH)											
1	Logical Unit Number		Reserved		ERA	Reserved	RelAdr					
2	Logical Block Address (MSByte)											
3	Logical Block Address											
4	Logical Block Address											
5	Logical Block Address (LSByte)											
6	Transfer Length (MSByte)											
7	Transfer Length											
8	Transfer Length											
9	Transfer Length (LSByte)											
10	Reserved											
11	PBA	Reserved				Flag	Link					

**ERA**

Erase All bit of 1 indicates that all remaining block are erased, starting from the specified Logical block Address to the end of the disk. Transfer Length must be set to 0. Erase All bit of 0 indicates that all blocks are erased, starting from the Logical Block Address to the end of the specified Transfer Length.

**Transfer Length**

This field indicates the number of contiguous logical blocks to be erased for this command. A field value of 0 indicates that no blocks will be erased and is no considered as an error.

**PBA**

Physical Block Address bit of 1 indicates that Physical block addressing is used. Physical Block Address bit 0 indicates that logical block addressing is used.

Write-Once Medium

If this command is executed for Write-Once medium, the drive returns a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 05H/20H/00H (ILLEGAL REQUEST/Invalid Command Operation Code).

**Note:**

When this command is issued while 600 Mbyte/650 Mbyte media and 1.2 Gbyte/1.3 Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

# WRITE AND VERIFY(12)

**AEH**

## FUNCTION

Writes the specified number of data blocks starting from the specified Logical Block Address and then verifies the WRITE by reading the written data and checking the Error Correction Code.

## CDB

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
<b>0</b>	Operation Code (AEH)							
<b>1</b>	Logical Unit Number		DPO	Reserved	EBP	Reserved	RelAdr	
<b>2</b>	Logical Block Address (MSByte)							
<b>3</b>	Logical Block Address							
<b>4</b>	Logical Block Address							
<b>5</b>	Logical Block Address (LSByte)							
<b>6</b>	Transfer Length (MSByte)							
<b>7</b>	Transfer Length							
<b>8</b>	Transfer Length							
<b>9</b>	Transfer Length (LSByte)							
<b>10</b>	Reserved							
<b>11</b>	PBA	ErsCntrl		Reserved		Flag	Link	

## DPO

Disable Page Out bit of 1 instructs the drive not to store the data in the cache after it has been transferred to the medium. Disable Page Out bit of 0 instructs the drive to store the data in the cache after it has been transferred to the medium. However, this bit is ignored.

## EBP

If the Erase Bypass bit is set to 0, the ERASE operation is automatically performed before writing the data. Erase Bypass bit of 1 suppresses the ERASE operation.

## Transfer Length

This field indicates the number of contiguous logical blocks to be transferred for this command. A field value of 0 indicates that no blocks will be transferred and this is not considered as an error.

**PBA**

Physical Block Address bit of 1 indicates that the physical block addressing is used. Physical Block Address bit of 0 indicates that the logical block addressing is used.

**ErsCntl**

Erase Control bit is identical to Erase Bypass bit.

Write-Once Medium

If a written block is detected during the operation of this command, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/92H/00H (BLANK CHECK/ Overwrite Attempted).

**Note:**

When this command is issued while 600 Mbyte/650 Mbyte media and 1.2 Gbyte/1.3 Gbyte media are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

**VERIFY(12)****AFH****FUNCTION**

Verifies the specified number of data blocks starting from the specified Logical Block Address by reading the data and checking the Error Correction Code.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
<b>0</b>	Operation Code (AFH)							
<b>1</b>	Logical Unit Number		DPO	Reserved	BlkVfy	Reserved	RelAdr	
<b>2</b>	Logical Block Address (MSByte)							
<b>3</b>	Logical Block Address							
<b>4</b>	Logical Block Address							
<b>5</b>	Logical Block Address (LSByte)							
<b>6</b>	Verification Length (MSByte)							
<b>7</b>	Verification Length							
<b>8</b>	Verification Length							
<b>9</b>	Verification Length (LSByte)							
<b>10</b>	Reserved							
<b>11</b>	Reserved				Flag	Link		

**DPO**

Disable Page Out bit of 1 instructs the drive not to retain the data in the cache after it has been verified. Disable Page Out bit of 0 instructs the drive to retain the data in the cache after it has been verified. This bit is ignored.

**BlkVfy**

Blank Verify bit of 1 indicates the drive verifies if the specified sectors are erased. Blank Verify bit of 0 indicates that the drive verifies the written data integrity.

**Verification Length**

This field indicates the number of contiguous logical blocks to be verified for this command. A field value of 0 indicates that no blocks will be verified and this is not considered as an error.

**Note:**

If a blank sector is detected during operation, the drive returns a CHECK CONDITION status and sets the Sense Key/Additional Sense Code/Additional Sense Code Qualifier to 08H/93H/00H (BLANK CHECK/Blank Sector Detected).

**READ DEFECT DATA(12)****B7H****FUNCTION**

Reads the optical disk defect information. The returned data contains an eight byte header, followed by zero or more Defect Descriptor.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
<b>0</b>	Operation Code (B7H)										
<b>1</b>	Logical Unit Number			PList	GList	Defect List Format					
<b>2</b>	Reserved										
<b>3</b>	Reserved										
<b>4</b>	Reserved										
<b>5</b>	Reserved										
<b>6</b>	Allocation Length (MSByte)										
<b>7</b>	Allocation Length										
<b>8</b>	Allocation Length										
<b>9</b>	Allocation Length (LSByte)										
<b>10</b>	Reserved										
<b>11</b>	Reserved					Flag	Link				

**PList & GList**

Grown List bit of 1 (and regardless of Primary List bit) indicates that the drive will return the contents of Primary Defect List and Secondary Defect List. Primary List bit of 1 and Grown List of 0 indicates that the drive will only return the contents of Primary Defect List.

**Defect List Format**

This field specifies the Format of Defect List which is to be returned. Only the Physical Sector Format(5) is supported. If the Block Format(0) is specified, the defect list will be returned in Physical Sector Format and a CHECK CONDITION status will be returned at the completion of the command with Sense Key/Additional Sense Code/Additional Sense Code Qualifier set to 01H/19H/01H (RECOVERED ERROR/Defect List Not Available).

### Allocation Length

This field specifies the number of bytes that the initiator has allocated for the return of this data. Allocation Length of 0 indicates that no data will be returned. This condition is not considered as an error. The drive will terminate the data-in-phase when the Allocation Length has been transferred or when all the available defect data has been transferred to the initiator, whichever is less.

In this command, the READ DEFECT DATA header is extend to 8-byte. READ DEFECT DATA header is as follows.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Reserved
1			Reserved	PList	GList			Defect List Format
2								Reserved
3								Reserved
4								Defect List Length (MSByte)
5								Defect List Length
6								Defect List Length
7								Defect List Length (LSByte)

### PList

Primary List bit of 1 indicates that the Primary List of defects is returned.

### GList

Grown List bit of 1 indicates that the Grown List of defects is returned.

### Defect List Format

This field will be set as the same value indicated in Defect List Format field (which has the fixed value of 5) of CDB. And this specifies the format of the Defect List Data returned by the drive.

### Defect List Length

This field specifies the total length of the Defect Descriptor that follows in bytes.

The format of Physical Sector Format Defect Descriptor is shown in the following table:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Physical Track Number of the Defect (MSByte)
1								Physical Track Number of the Defect
2								Physical Track Number of the Defect (LSByte)
3								Reserved
4								Reserved
5								Reserved
6								Reserved
7								Defective Physical Sector Number

**READ LONG\*****DEH****FUNCTION**

Read data from the specified Logical Block Address with Error Correction Code data.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0				
0	Operation Code (DEH)											
1	Logical Unit Number			Reserved				RelAdr				
2	Logical Block Address (MSByte)											
3	Logical Block Address											
4	Logical Block Address											
5	Logical Block Address (LSByte)											
6	Reserved											
7	Transfer Length (MSByte)											
8	Transfer Length (LSByte)											
9	Reserved				Flag	Link						

**Transfer Length**

This field specifies the number of logical blocks to be transferred. Total number of data bytes to be sent from the initiator are multiple of the transfer length and sector size.

- \* 2048 media = 2380 bytes (2048 data + 332 pointers, CRC, pad and ECC)
- \* 1024 media = 1200 bytes (1024 data + 176 pointers, CRC, pad and ECC)
- \* 512 media = 630 bytes (512 data + 118 pointers, CRC, pad and ECC)  
(4.1Gbyte media)
- \* 512 media = 610 bytes (512 data + 98 pointers, CRC, pad and ECC)  
(600 Mbyte, 1.2Gbyte and 2.3Gbyte media)

**Note:**

If a blank block is detected during blank checking, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/93H/00H (BLANK CHECK/Blank Sector Detected).

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\* This command is a vendor unique command.

**WRITE LONG\*****DFH****FUNCTION**

Writes data to the specified Logical Block Address without using the Error Correction Code.

**CDB**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
0	Operation Code (DFH)										
1	Logical Unit Number				Reserved			RelAdr			
2	Logical Block Address (MSByte)										
3	Logical Block Address										
4	Logical Block Address										
5	Logical Block Address (LSByte)										
6	Reserved										
7	Transfer Length (MSByte)										
8	Transfer Length (LSByte)										
9	Reserved	ErsCtl	Reserved				Flag	Link			

**Transfer Length**

This field specifies the number of logical blocks to be transferred. Total number of data bytes to be sent from the initiator are multiple of the transfer length and sector size.

\* 2048 media = 2380 bytes (2048 data + 332 pointers, CRC, pad and ECC)

\* 1024 media = 1200 bytes (1024 data + 176 pointers, CRC, pad and ECC)

\* 512 media = 630 bytes (512 data + 118 pointers, CRC, pad and ECC)

(4.1Gbyte media)

\* 512 media = 610 bytes (512 data + 98 pointers, CRC, pad and ECC)

(600 Mbyte, 1.2Gbyte and 2.3Gbyte media)

**ErsCtl\*\***

Erase Control bit of 0 orders the automatic ERASE operation before writing the data. Erase Control bit of 1 suppress the automatic ERASE operation. This is an option for applications which require fast data writing.

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\* The command is a vendor unique command.

\*\* This bit is a vendor unique bit.

Write-Once Medium

If a written block is detected during the operation of this command, the drive will return a CHECK CONDITION status. Then the Sense Key/Additional Sense Code/Additional Sense Code Qualifier will be set to 08H/92H/00H (BLANK CHECK/ Overwrite Attempted).

**Note:**

When this command is issued while 600 Mbyte/650 Mbyte media and 1.2 Gbyte/1.3 Gbyte are inserted, the drive will return the Sense Key/Additional Sense Code/Additional Sense Code Qualifier is set to 07H/27H/00H (DATA PROTECT/Write Protected).

## **Appendix A: Internal Error Code**

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X's are arbitrary characters. The last two characters of Internal Error Code (NN) indicates either ODC or DSP Error Code.

Error Code	Name	Description
012BXXXX	SC MSG INVALID	Invalid SCSI message received
012CXXXX	SC IDMSG INVBIT	Invalid bit of Identify message set to one
012DXXXX	SC MSG PERR	Parity error detected while receiving a SCSI message
012EXXXX	SC MSG RJERR	SCSI message rejected
012FXXXX	SC MSG ATERR	Attention signal asserted after Message Out Phase
0130XXXX	SC PARITY ERR	SCSI I/F parity error detected
0131XXXX	SC IDE RCVD	Initiator Detected Error Message is received
0133XXXX	SC SYND ERR	Offset of synchronous data transfer is too large
0134XXXX	SC SHORT PRD	Period of synchronous data transfer is too short
0139XXXX	SC CLEAR QUE	Clear Queue message received
013AXXXX	SC RESELECT	No response from Initiator for reselection
013BXXXX	SC FATAL	Unusual SCSI controller condition
013CXXXX	SC FATAL2	Unusual SCSI controller condition
0204XXXX	MCODE INVALID	Invalid micro code data received
020AXXXX	CDB0 INVALID	Invalid Operation Code specified
020BXXXX	LBA RANGE INVALID	Invalid LBA range specified
020CXXXX	CDB FIELD INVALID	Invalid field in CDB specified
020DXXXX	PARAM LIST INVALID	Invalid parameter list specified
0210XXXX	PR LIST LEN ERROR	Invalid parameter list length
0211XXXX	SAV PARAM NO SPPORT	Parameter saving function not supported
0212XXXX	SAV PARAM NOTRDY	Parameter not currently saved
0213XXXX	EJECT PREVENTED	Cartridge eject prevented
0250XXXX	OVERWT ERR	Overwriting on already written sector of Write-Once media attempted
0254XXXX	QUE CMD CLEARED	Queued command cleared by another initiator
0255XXXX	QUE OVERLAPPED CMD	Command received for the same ITL (or ITLQ) nexus

Error Code	Name	Description
026CXXXX	INVALID CCW COM	Invalid command for Write-Once media specified
0321XXXX	LOADER FATAL	Loader task ended with unusual condition
0322XXXX	INIT LOADER ERR	Sensor failure upon loader initialization
0323XXXX	RECOVER LOADER ERR	Failed in recovery procedure of loader initialization
0324XXXX	LOAD DISK ERR	Cartridge loading failure
0327XXXX	UNLOAD DISK ERR	Cartridge unloading failure
0416XXXX	START/STOP EXEC	Proceeding Start/Stop command
0417XXXX	DRC INITIALIZE	Loader being initialized
0418XXXX	DRC NO DISK	No cartridge in drive
041AXXXX	DRC SPINNING UP	Media being spun-up
041BXXXX	DRC LOADING	Media being loaded
041CXXXX	DRC LOAD COMPLETE	Media load complete
041DXXXX	DRC DRIVE NOT READY	Drive not ready
041EXXXX	DRC SPINNING DOWN	Media being spun-down
041FXXXX	DRC UNLOADING	Media being unloaded
0420XXXX	DRC UNKNOWN	Drive unable to be Ready due to unknown reason
0425XXXX	BECOME TO READY	Drive in process of becoming ready
046FXXXX	DRC FORMATTING	Drive in process of formatting a medium
0514XXXX	DEFL FORM INVALID	Defect List Format not supported
0515XXXX	WRITE PROTECTED	Cartridge protected from writing data
0528XXXX	INVALID ID HOLE	Invalid ID hole of the cartridge
0529XXXX	NOT SUPPORT MEDIUM	Media not supported
053EXXXX	PDL ERROR	Invalid PDL data
053FXXXX	SDL ERROR	Invalid SDL data
0540XXXX	DDS NOT FOUND	DDS sectors not found
0541XXXX	PDL NOT FOUND	PDL sector not found
0542XXXX	SDL NOT FOUND	SDL sector not found
0543XXXX	CANNOT READ DMA	DMA sector cannot be read
0544XXXX	DDS INVALID	Invalid DDS data
0545XXXX	CANNOT READ SFP	SFP sector cannot be read
0546XXXX	SFP INVALID	Invalid SFP data
0547XXXX	EWR TEST ERR	Erase/BlankCheck/Write/Read/Compare test failure after media load up and spin-up
0548XXXX	NO DEFECT SPARE	Exhausted spare area for defective sector
0549XXXX	DEFECT UPDATE ERR	DMA sectors update failure

Error Code	Name	Description
054AXXXX	PEP INVALID	DMA sectors update failure
054BXXXX	RW REALLOC	Defective sector recovered with automatic write reallocation procedure
054CXXXX	REALLOC FAIL	Automatic write reallocation procedure failure
0551XXXX	BLANK ERR	Blank sector detected
0577XXXX	ID WREALLOC	Automatic Write Reallocation performed due to ID Error
0578XXXX	ECC WREALLOC	Automatic Write Reallocation performed due to Uncorrectable ECC Error
0579XXXX	SYNC WREALLOC	Automatic Write Reallocation performed due to SYNC Error
057AXXXX	FLT WREALLOC	Automatic Write Reallocation performed due to Servo Fault Error
057EXXXX	ID RECOVER	ID Error recovered by retry
057FXXXX	ECC RECOVER	Uncorrectable ECC Error recovered by retry
0580XXXX	SYNC RECOVER	SYNC Error recovered by retry
0581XXXX	FLT RECOVER	Servo Fault Error recovered by retry
0582XXXX	RDNEXT IDERR	ID Error even with a retry after changing the ID Error criteria
0583XXXX	AR DMAUPT ERR	DMA Update failed after Automatic Reallocation
058AXXXX	UPDDMA COND	DMA Update failed
0601XXNN	ODC ERROR	Error code NN received (refer to Appendix B: ODC Error Code Table)
0664XXXX	DCM TMOUT	ODC interrupt time out
0669XXXX	NGID 1K512	Media type cannot be distinguished (ID Status = CRC NG)
066AXXXX	NO PBINT	Media type cannot be distinguished (No ODC Interrupt)
066DXXXX	NGID QSFP	SFP sector cannot be read (ID Status = CRC NG)
0670XXXX	ODCABT FAIL	Cannot abort ODC command
0692XXNN	ODC2 ERROR	Error code NN received (refer to Appendix B: ODC Error Code Table)
0702XXNN	DSP ERROR	Error code NN received from DSP (refer to Appendix C: DSP Error Code Table)
075CXXXX	DSPDLOAD ERR	Down-load DSP code error
075EXXXX	DSPRSS ERR	DSP request command communication error

Error Code	Name	Description
0760XXXX	DSPCMU ERR	DSP command communication error
0762XXXX	DSPECHO ERR	ECHO command of DSP failure
0767XXXX	IKISUGI	Target sector cannot be found (time out after seek complete)
0774XXXX	WRITE FAULT	Servo failure during write operation
0789XXXX	LPCCAL FAIL	LPC Calibration failed
078BXXXX	IDOST FAIL	ID Offset Calibration failed
078CXXXX	MOOST FAIL	MO Offset Calibration failed
078DXXXX	VFOO FAIL	VFO Offset Calibration failed
078EXXXX	IDVGA FAIL	ID VGA Calibration failed
078FXXXX	MOVGA FAIL	MO VGA Calibration failed
0791XXXX	FCSBIAS FAIL	Focus Bias Calibration failed
093DXXXX	RW ABORT	Read/Write task aborted
0957XXXX	PON DIAG TOUT	Power-On diagnostic time out
0959XXXX	ROM CHECK SUM	ROM Check Sum error
095AXXXX	DSPFUNC ILG	Illegal request for DSP Interface task
095FXXXX	DSPPRM LEN	Command Parameter Length contradiction to DSP
0961XXXX	DSPRLW ERR	Release wait of DSP I/F task
0965XXXX	DCM ABORT	ODC command aborted
0968XXXX	RWFUNC ILG	Illegal request to Read/Write task
096EXXXX	PARAM INVALID	Invalid Parameter Block data
0A4FXXXX	LINE 12V ERR	12V line not supported
0A71XXXX	RAM DIAG ERR	RAM Test Error
0A72XXXX	ODC DIAG ERR	ODC Test Error
0E03XXXX	FLASH UPD ERR	Flash ROM update failure
0E05XXXX	SAVE PARAM ERR	Parameter save failure
0E56XXXX	PARAM BLK ERR	Parameter block not saved or invalid value

## **Appendix B: ODC Error Code**

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These error codes may be indicated as part of Internal Error Code (Last two characters, NN).

<b>Error Code</b>	<b>Name</b>	<b>Description</b>
01	DCM_STOP	ODC command aborted
08	SEARCH_NG	Invalid search condition
11	E_LMT	Number of error bytes exceeding the limit
12	S_LMT	Cannot detect SYNC
13	ES_LMT	Both error 11 and 12
14	R_LMT	Number of RESYNC misdetection exceeding the limit
15	ER_LMT	Both error 11 and 14
16	RS_LMT	Both error 12 and 14
17	ESR_LMT	Both error 13 and 14
20	SM_ERR	SM (Sector Mark) error
21	IDCRC_ERR	ID CRC error
22	SYNC_ERR	Cannot detect SYNC and the first RESYNC
23	RDSHORT_ERR	DTRG becomes non-active before all the data of sector is transferred
24	UNCORE_ERR	Uncorrectable error
25	CRC_ERR	CRC error (Uncorrectable)
29	RDOVR_ER	Read Data Over Run error detected
31	WTUDR_ERR	Write Data Over Run error detected
32	DSV_ERR	DSV (Digital Sum Value) error
34	BLK_ERR	Written Sector detected
42	B_BCHK_ERR	Buffer Memory WRITE/READ/COMPARE error
44	SGOVR_ERR	Cannot proceed error correction because of the exhausting syndrome buffer
45	ECCTOUT_ERR	Cannot correct error bytes within time (= time to pass one sector)
46	WTSHORT_ERR	Write data transfer to encoder too short
47	WTLONG_ERR	Write data transfer to encoder too long
48	ECCFATAL_ERR	Unexpected sequence of error correction
4E	ODCINT_ERR	Unexpected interrupt detected in the ODC chip
4F	ODCTOUT_ERR	Unexpected firmware sequence in ODC chip

<u>Error Code</u>	<u>Name</u>	<u>Description</u>
50	EQC_ERR	Asynchronous interrupt of DSP detected
51	OFFTRK_ERR	Unexpected ID value is detected
52	ID_CRPT_ERR	Both unexpected and expected ID value are detected on one sector.
54	TARGETOVR_ERR	Target sector already passed when current position is detected
57	ILGSEC_ERR	Detected ID sector number is greater than the maximum sector number
70	NOTPL_ERR	Parameter List not prepared
71	ILGPLSEC_ERR	Sector number of Parameter List is greater than the maximum sector number
72	ILGPLCNT_ERR	Sector count of Parameter List set to 0 in W/R/S
73	ILGPLCND_ERR	Undefined condition set in DTS and DLS command
7D	ILGSETUP_ERR	Set-up command issued while executing Identify operation
7E	DBLCOM_ERR	Command issued while executing another command
7F	NOTCOM_ERR	Undefined command issued

## **Appendix C: DSP Error Code**

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These error codes may be indicated as part of Internal Error Code (Last two characters, NN). Error codes with asterisk( \*) are only for internal use and not intended to be reported to the host as a command error.

<b>Error Code</b>	<b>Name</b>	<b>Description</b>
01	MEASFLR	Offset measurement failure (Servo signal offset was too large)
09	IDACCALFLR	IDAC calibration failure
0B	NOIDINTVGACAL	Read channel VGA calibration failure (1X / 2X / 4X / 8X)
0C	NOCALIBVGACAL	Read channel VGA calibration failure (1X / 2X / 4X / 8X)
0D	PCALRCFLR	Read channel OST calibration failure(4X / 8X)
0E	NORCHDATA	Read channel MOVGA calibration failure(1X / 2X)
0F	FCSFLRVGACAL	FCSFLR VGA calibration failure(4X / 8X)
10	IDVGACALFLR	Read channel IDVGA calibration cannot be arranged.(4X / 8X)
11	MISCHUCK2	Medium mischucking (FCSFLR error)
21	SPOFFABT	Spindle off aborted
34*	CALIBREQ	LD power calibration request
41	NORDY	Drive not ready
43	IMITATEATT	Imitate ATT happen for ESD
44	IDSRCHFCSFLR	FCS failed at id search
52	ILLGLZONE1	Illegal zone selected (ALTERNATE ZONE)
54	ILLGLZONE3	Illegal target zone selected for SEEK command (SEEK start)
55	ILLGLZONE4	Illegal target zone selected during OTJ (SEEK OTJ)
56	ILLGLZONE5	Illegal target zone (SEEK landing)
57	ILLGLZONE6	Illegal next zone (SEEK landing)
58	ILLGLZONE7	Illegal zone (ID search)
59	ILLGLZONE8	Illegal zone (ID search)
5A	ILLGLZONE9	Illegal zone (Focus search)
5B	KINERR	Kick inner area failed
5C	AGCTIMEOUT	Servo AGC time out

Error Code	Name	Description
61	FCSONFLR	Focus on failed
62	FCSONABT	Focus on aborted
64	TRKDRVFLR	Tracking Drive Saturation
65	NOID1	No ID (No SM or CRC NG) (DON start)
66	NOID2	No ID (No SM or CRC NG) (SEEK start)
67	NOID3	No ID (No SM or CRC NG) (SEEK landing)
68	SLIPPY	Seek slip too much
69	SEEKTIMEOUT	Seek time out
6A	TOOLONGTOGO	Seek target is long time to go in OTJ.
6B	MTJTOOLONG	Too much time for Multi-Track Jump
6C	FCSFLR	Focus failure (Defocus or off focus servo)
6D	TRKFLR	Tracking failure (Detrack or off-track)
6E	LOPI	Low pull-in signal (Off focus servo)
6F	FCSDRVFLR	Focus drive saturation (Off focus servo)
71	NOPEP	Cannot detect PEP signal
72	PEPPOSFCSFLR	Focus failed (PEP positioning)
74	PEPRDFCSFLR1	Focus failed (searching PEP GAP)
75	PEPRDFCSFLR2	Focus failed (searching PEP PA)
76	PEPRDFCSFLR3	Focus failed (searching PEP data)
77	PEPRDFCSFLR4	Focus failed (before searching PEP data)
78	NOPEPGAP	No PEP GAP found
79	ILLGLPEPFMT0	Illegal PEP format found (PA)
7A	ILLGLPEPFMT1	Illegal PEP format found (data)
7B	PEPDECODEERR	PEP decoding byte count error
7C	PEPFUNNYSYNC	Funny PEP Sync found
7D	PEPNOSYNC	No PEP SYNC found
7E	PEPCRCNG	PEP CRC NG
7F	PEPCMPPER	1 <sup>st</sup> and 2 <sup>nd</sup> PEP data compare error

<u>Error Code</u>	<u>Name</u>	<u>Description</u>
C1	PSDNG	Bogo-PSD (Recalibrate)
C2	NOBMFLIP	Bias magnet failure
C9	NOLDPWR	No LD power
CA*	ASSERTWFLT	Assert write fault signal for controller debug
CF	TMPALRM	Temperature alarm
D1	ILLGLADR	Illegal address selected
D3	INVLDCMD	Invalid Command
D4	ESDIFLR	Communication Failure
E1	SPONFLR	Spindle lock time out
E2	SPOFFFLR	Spindle off failed
E3	MISCHUCK1	Medium mischucking (PONFLR)
E4	TDFCTFLR	Tracking Failure for certifier
E5	SPONFLR2	Spindle Lock time-out
E6	FDFCTFLR	Focus Failure for certifier
F1	ATT	Attention occurred
F3	REASETFLR	E/A R/C Serial Write Block NG
F4	LEASETFLR	E/A LPC Serial Write Block NG
F5	REAREADFLR	E/A R/C Serial Read Block NG

SMO-F551 series

## **Magneto-Optical Disk Drive**

SCSI Specifications